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CUMBERLAND FOSSIL PLANT RETIREMENT

FINAL ENVIRONMENTAL IMPACT STATEMENT

TENNESSEE VALLEY AUTHORITY
KNOXVILLE, TENNESSE

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COVER SHEET

Cumberland Fossil Plant Retirement

Proposed action: The Tennessee Valley Authority (TVA) proposes to retire and demolish the two coal-fired units at the Cumberland Fossil Plant (CUF) in Cumberland City, Stewart County, Tennessee and construct and operate natural gas-fired or solar generating facilities to replace part of the retired generation. The replacement generation would be (1) a gas-fired combined cycle plant on the CUF Reservation and associated new 32-mile gas pipeline lateral, (2) gas-fired combustion turbine plants at TVA's Johnsonville and Gleason generating plant sites, or (3) multiple solar generating facilities and battery energy storage systems mostly in Middle Tennessee.

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Abstract: TVA prepared this EIS to evaluate the environmental and social effects of the proposed retirement and demolition of the two Cumberland Fossil Plant (CUF) units and the addition of at least 1,450 MW of replacement electrical generation. In addition to the No Action Alternative, TVA is evaluating three alternatives for replacement of generation lost as a result of retiring one CUF unit: construction and operation of a combined cycle combustion turbine (CC) natural gas-fueled plant on the CUF Reservation and related gas pipeline (Alternative A); construction and operation of two simple cycle combustion turbine (CT) natural gas-fueled plants at alternate locations (Alternative B); and construction and operation of multiple solar generation and energy storage facilities, at alternate locations primarily in Middle Tennessee (Alternative C). This EIS evaluates related gas supply and transmission component actions associated with the respective alternatives. Under the No Action Alternative, TVA would not retire the

two CUF units and additional repairs and maintenance would be necessary to maintain reliability of those units for continued operation and comply with environmental regulatory requirements. Existing conditions at CUF and in the vicinity would be maintained and the continued management of coal combustion residuals would be required. TVA's Proposed Action Alternatives are in response to and consistent with the 2019 Integrated Resource Plan near-term actions to evaluate engineering end-of-life dates for aging generation units to inform long-term planning and to enhance system flexibility to integrate renewables and distributed resources. TVA's preferred alternative is Alternative A, as financial and system analysis indicate a CC gas plant is the best overall solution to replace the retiring CUF unit and provide low-cost, reliable, and cleaner energy to the TVA power system. TVA has also selected Alternative A as its preferred alternative because the proposed CC plant at CUF provides the flexibility to reliably integrate 10,000 MW of solar onto the system by 2035 and enables the CUF coal-fired units to be retired on an accelerated schedule. Further, unlike the other alternatives, the proposed CC plant could be built and made operational in the timeframe needed to reduce economic, reliability, and environmental risks.

SUMMARY

Introduction

Following the completion of the Tennessee Valley Authority (TVA) 2019 Integrated Resource Plan (IRP), TVA began conducting end-of-life evaluations of its operating coal-fired generating plants not already scheduled for retirement to inform long-term planning. This evaluation confirmed that the aging TVA coal fleet is among the oldest in the nation and is experiencing deterioration of material condition and performance challenges. The performance challenges are projected to increase because of the coal fleet's advancing age and the difficulty of adapting the fleet's generation within the changing generation profile. The continued long-term operation of some of TVA coal plants, including the Cumberland Fossil Plant (CUF), is contributing to environmental, economic, and reliability risks.

Summary of the Purpose and Need for the Proposed Action

The purpose of the Proposed Action is to retire and decommission the two coal-fired CUF units, one unit by 2026 and the other unit by 2028, and to provide replacement generation that can supply 1,450 MW of firm, dispatchable power by the time the first unit is retired in 2026. The need for the Proposed Action is to ensure that TVA is able to meet required year-round generation and maximum capacity system demands and planning reserve margin targets, particularly during peak load events. Planning for the replacement generation for the second retired CUF unit would be deferred to allow consideration of a broader range of replacement generation alternatives depending on system needs and the state of technology at the time replacement is needed.

Summary of the Alternatives

In this EIS, TVA assesses a No Action Alternative and three Action Alternatives. Under all Action Alternatives, two CUF units would be retired and demolished. The three action alternatives provide at least 1,450 MW of replacement generation using one of the following: (1) construction and operation of a combined cycle combustion turbine (CC) natural gas-fueled plant on the CUF Reservation and associated 32-mile gas pipeline (Alternative A); (2) construction and operation of simple cycle combustion turbine (CT) natural gas-fueled plants at two alternate locations (Alternative B); and (3) construction and operation of solar generation and energy storage facilities at alternate locations primarily in Middle Tennessee (Alternative C). This EIS also evaluates connected actions associated with the gas supply and transmission components of the respective alternatives.

Under the No Action Alternative, TVA would not retire the two CUF units; therefore, additional repairs and maintenance of the two coal units would be necessary to maintain system reliability and comply with environmental regulatory requirements. Existing conditions at CUF and in the vicinity would be maintained and the continued management of coal combustion residuals (CCRs) would be required. TVA's Proposed Action Alternatives align with the 2019 IRP near-term actions to evaluate engineering end-of-life dates for aging generation units to inform long-term planning and to enhance system flexibility to integrate renewables and distributed resources. TVA's Preferred Alternative is Alternative A, as financial and system analysis indicate a CC gas plant is the best overall solution at this time to replace the retiring CUF unit and provide low-cost, reliable, and cleaner energy to the TVA power system. TVA has also selected Alternative A as a preferred alternative because the proposed CC plant enables the accelerated retirement of the first CUF coal-fired unit; provides the flexibility needed to reliably integrate 10,000 MW

of solar onto the system by 2035; and could be built and made operational in the timeframe needed to reduce economic, reliability, and environmental risks. The Preferred Alternative replaces coal-fired generation, consistent with the target supply mix adopted in the 2019 IRP and the Coal End-of-Life Evaluation for the aging coal fleet, and meets the purpose and need of the proposed action to have the replacement generation operating by 2026.

The following summary of resources focuses on the Preferred Alternative, Alternative A. A summary level comparison of all alternatives is provided in Section 2.2, while detailed information about the affected environment and environmental consequences associated with each Action Alternative for each resource area is contained within Chapter 3. The proposed pipeline to provide natural gas to the Alternative A CC plant is subject to Federal Energy Regulatory Commission (FERC) approval and FERC is preparing a separate EIS on the proposed natural gas pipeline. Information on the affected environment and environmental consequences of the construction and operation of the pipeline provided by Tennessee Gas Pipeline (TGP), the pipeline developer and operator, is incorporated into this CUF EIS.

Environmental Justice

Affected Environment

Using CEQ criteria, no census block groups within the CUF Reservation environmental justice (EJ) study area were identified as minority EJ populations. However, three minority EJ populations were identified in the TGP EJ review of the pipeline corridor, and those minority populations have been incorporated into the analysis in this EIS. Low-income EJ populations were identified in each study area, consisting of two census blocks in the CUF Reservation EJ study area and one census block in the pipeline corridor EJ study area. Three additional low-income EJ populations identified in the TGP pipeline EJ review were also incorporated into the analysis.

Environmental Consequences

Under Alternative A, amplified effects to EJ populations are projected with CUF coal unit retirement and implementation of other aspects of Alternative A. These are associated with effects to surface water, air quality, aquatic life, recreation, transportation, utilities, waste, safety, socioeconomics, noise, and visual aesthetics. Effects to other resources areas associated with Alternative A, including physical resources, land use, vegetation, wildlife, wetlands, threatened and endangered species, utilities, and cultural resources, would be temporary and minor to minimized or mitigated and/or limited to the immediate disturbance footprints. Where effects extend offsite, these would likewise be minor to mitigated and are not anticipated to be amplified for EJ populations due to specific regulatory requirements, such as stakeholder involvement in cultural resources decision-making or the protected status of threatened and endangered species. Minor beneficial effects to EJ and other populations would also occur with implementation of Alternative A due to temporary local employment increases, upgrades to public recreational facilities on the CUF Reservation, and positive effects to water quality, air quality, and aquatic life.

Physical Characteristics (Geology, Soils, Prime Farmland, and Floodplains)

Affected Environment

The CUF Reservation lies in the Western Highland Rim Physiographic Province of Tennessee, which is characterized by rolling hills and incised valleys. Regionally, the

underlying bedrock is chiefly Mississippian to Ordovician-age limestone, chert, shale, siltstone, and sandstone (Luther 2018; Griffith et al. 1997). The CUF Reservation is situated in the Wells Creek Basin, which is part of the Wells Creek Structure, formed by a meteor impact. This structure consists of a series of roughly circular concentric faults, with radial faults emanating from the center of the basin. While prime farmland is present on CUF, some of these acres were previously impacted by the construction of existing structures, and therefore, would no longer be considered prime farmland. The remaining potential prime farmland soils are located on federal property and land use is planned for industrial use; thus, the conversion of those soils has also already occurred. The Reservation is located between Cumberland River miles 102.0 and 104.6, on Barkley Lake, in Stewart County, Tennessee. Scott Branch and Wells Creek are two tributaries that cross the CUF Reservation.

Environmental Consequences

Minor direct effects to geology would occur during demolition of the coal plant and construction of the CC plant and related pipeline and transmission lines. Geologic features, such as sinkholes or karst terrain, would be avoided or mitigated. Minor direct effects to soils would be reduced using appropriate Best Management Practices (BMPs). Floodplains would be avoided, and effects would be minimized by maintaining pre-construction hydrology.

Water Resources (Groundwater, Surface Water, Water Quality, and Wetlands)

Affected Environment

The CUF Reservation overlies the Mississippian carbonate aquifer system. CUF is located just to the north of the center of the Wells Creek Structure. The center of the structure to the south of the plant is mostly overlain by the Wells Creek Embayment. This embayment is low lying and drains into the Cumberland River to the north. Wells Creek drains from the south to the north and borders the southern and western portion of CUF. Wetlands and perennial, intermittent, and ephemeral streams are located on the CUF Reservation and on the CC plant site. Mooring structures are within the Cumberland River. The natural gas pipeline corridor also contains wetlands, ponds, and perennial, intermittent, and ephemeral streams.

Environmental Consequences

There is a potential for direct minor but temporary effects from the demolition of the mooring cells located in the Cumberland River, and both direct and indirect minor but temporary effects from the demolition of the existing coal plant. There is the potential for stream and wetland impacts associated with construction of the CC plant and related pipeline and transmission corridors. Applicable Clean Water Act (CWA) Section 404 permits and Section 401 certifications would be obtained from U.S. Army Corps of Engineers (USACE) and Tennessee Department of Environment and Conservation (TDEC), respectively, and necessary mitigation credits purchased if impacts to wetlands and streams cannot be avoided. Erosion and sediment control BMPs would be used to minimize direct and indirect effects to wetlands and streams. Minor effects to groundwater may occur but would be mitigated through the use of BMPs. Avoidance, minimization, and mitigation efforts are expected to reduce or eliminate the potential for cumulative effects to streams and wetlands.

Air Quality and Greenhouse Gases, Climate Change

Affected Environment

The CUF Reservation is located in Stewart County, Tennessee, which is an attainment area for all criteria pollutants. The CUF Reservation is currently a Prevention of Significant Deterioration (PSD) major source and is subject to a Title V air operating permit. The associated 32-mile natural gas pipeline would pass through Dickson, Houston, and Stewart counties. All three counties are currently in attainment for all criteria pollutants.

Environmental Consequences

Decontamination and deconstruction of the coal plant and construction of the CC plant are expected to have short-term, localized, and minor effects on air quality and no appreciable direct or indirect effect on regional climate change. The replacement of CUF coal-fired plant generation with natural gas-fired CC plant generation would have long-term, moderate, beneficial effects on local air quality and on regional climate change in comparison to the No Action Alternative.

Biological Resources (Vegetation, Wildlife, Aquatic Life, Threatened and Endangered Species)

Affected Environment

The CUF Reservation and surrounding areas are located within the Western Highland Rim, a subregion of the Interior Plateau Ecoregion. Outside of the existing coal plant, most of the CUF Reservation is forested with deciduous plant communities or disturbed, agricultural fields. Deciduous forests located on the CUF Reservation provide habitat for an array of terrestrial animal species, including birds and bats. The primary aquatic environments related to CUF include Barkley Reservoir, Cumberland River (a tributary to the Ohio River), Wells Creek, and Scott Branch. Several state and federally protected fish, wildlife, and plant species occur or have the potential to occur on or in the vicinity of the CUF Reservation and along the associated pipeline route. No federally designated critical habitat is located on the CUF Reservation or along the natural gas pipeline route.

Environmental Consequences

Construction of the proposed CC plant and associated pipeline and transmission lines would affect vegetation by converting forested areas to industrial land uses and/or maintained utility corridors. Vegetation within the transmission line and pipeline rights-of-way would be managed as scrub/shrub and herbaceous land to assure the safe and reliable operation of the facilities.

Wildlife, such as birds, reptiles, or amphibians, could also be impacted during demolition activities and construction of the CC plant and associated pipeline and transmission lines. Some mobile wildlife habituated to the area are likely to move to other suitable environments offsite or outside of the demolition boundary, which are plentiful. Following construction, most of the areas cleared for temporary workspace and for pipeline construction would naturally re-vegetate to pre-construction conditions, and resident wildlife species utilizing early successional habitats would not be subject to long-term impacts.

The retirement of CUF would result in elimination of entrainment and impingement mortality of fish and mollusks in the vicinity of the CUF cooling water intake structure.

Thermal discharges would also cease, generally improving water quality. No impacts would occur to aquatic life due to the construction of the CC plant, temporary construction support and laydown areas, or switchyard. No direct impacts to aquatic resources would occur from the transmission lines. Streams within or near the transmission line corridors could be impacted by surface water runoff increasing siltation; however, appropriate BMPs, including sediment and erosion control devices, such as silt fencing, would be installed to prevent and minimize risk to surface waters from construction activities.

Upgrades to the barge facility would result in permanent impacts to approximately 250 linear feet (lf) of shoreline along the Cumberland River. Given the size of the Cumberland River, it is likely that any resources in this area could be found by aquatic life in nearby areas. Temporary impacts would include turbidity and noise disturbances during construction upgrades. Impacts would be minimized through the applicable permitting process and adherence to BMPs outlined in TVA's BMP manual.

No permanent impacts to aquatic resources containing aquatic life would occur from construction of the natural gas pipeline. Temporary impacts would occur to 702 lf of perennial stream channel as a result of pipeline installation (dry open cut). Streams would be returned to original grade following installation of the pipeline.

There would be no long-term impacts to surface waters, and therefore to aquatic life, associated with the CC plant or natural gas pipeline.

Direct effects to state or federally listed threatened and endangered aquatic species are not anticipated to occur from CUF retirement and demolition. Tree removal for construction of the proposed facility would affect low, medium, and high-quality summer roosting bat habitat due to clearing within the CC plant footprint or habitat conversion for transmission line ROWs. The U.S. Fish and Wildlife Service (USFWS), in consultation with TVA under Section 7 of the Endangered Species Act (ESA), acknowledged that approximately 42 acres of incidental "take" would be used from TVA's programmatic consultation with USFWS regarding routine actions that may affect federally listed bats. The USFWS also concurred with TVA's determination that the construction of the CC plant and transmission lines under Alternative A may affect, but is not likely to adversely affect, Braun's rockcress, leafy prairie-clover, Price's potato-bean, Pyne's ground plum, Short's bladderpod, and gray bat. Clearing and construction of the natural gas pipeline would also result in impacts to bat habitat; on March 10, 2022, the USFWS stated that the pipeline project is not likely to adversely affect Price's potato-bean, Short's bladderpod, rabbitsfoot, tan riffleshell, Indiana bat, northern long-eared bat, and gray bat. To minimize effects to bat species, tree removal is recommended to occur between November 15 and March 31, to the extent feasible, when these bats are not roosting in trees. Tree removal during this timeframe would also avoid direct effects to nesting migratory songbirds and other birds of conservation concern.

Natural Areas, Parks, and Recreation

Affected Environment

A boat ramp is located on the CUF Reservation, and several public and commercial recreation and natural areas are in the vicinity of CUF. Natural areas, parks, and recreation areas are also located near the proposed pipeline. No Wild and Scenic Rivers occur in the Alternative A project area.

Environmental Consequences

Public access to the boat launching ramp on the CUF reservation could be temporarily interrupted during construction. The existing barge unloading area would continue to serve as a public boat ramp after construction is complete. Adverse effects to boat launching activities would be temporary and minor during construction but beneficial and long-term after construction is complete. No additional effects on natural areas, parks, and recreation areas in the project vicinity are anticipated. No direct, long-term effects to natural areas, parks and recreation would occur as a result of the associated pipeline construction and operation.

Land Use

Affected Environment

Much of the CUF Reservation is a heavily disturbed industrial area. The CC plant site on the CUF Reservation is largely a greenfield site composed of fields, woodlands, and wetlands and has been farmed in the past. Land within the pipeline corridor is largely deciduous forest and pastureland.

Environmental Consequences

Once the coal plant is demolished, there is the potential for land use changes if the coal plant site is redeveloped. Much of the CC plant site would change from the current, largely agricultural use to industrial and the rest of the site would remain largely undeveloped. Land use within the pipeline corridor would be impacted by construction in the short-term, with some land uses resuming after construction is complete when pasture and cropland is restored. There would be long-term, direct impacts to the land currently being used for forest management along the pipeline corridor, as it would be eliminated and converted to maintained open space. Some other potential future land uses would also be restricted.

Transportation

Affected Environment

CUF is served by highway, railway, and waterway modes of transportation. The pipeline lateral is served by highway and railway modes of transportation.

Environmental Consequences

Traffic volume generated by the deconstruction and construction workforce and the construction-related vehicles would be minor and temporary. Project materials and equipment would be delivered to the CC plant site by highway for smaller items and railway or waterway for larger items. Transportation of materials for the pipeline would be by truck and materials would be staged at several locations along the pipeline corridor.

Utilities

Affected Environment

The CUF Reservation is currently served by telecommunication providers, Cumberland Electric Membership Corporation, and Cumberland City utilities. Because the pipeline corridor is predominantly outside incorporated municipality limits, some utilities may not be available and water supply may be provided by private wells.

Environmental Consequences

During demolition of the coal plant, all buried utilities would be cut and capped within the project boundary and abandoned in place if they do not interfere with other ongoing projects in the vicinity. Prior to starting CC plant construction, TVA would coordinate with existing telecommunications, electricity, natural gas, and water and sewer utilities. During construction of the pipeline, service disruptions would be minimized through coordination between the pipeline developer, TVA, and the affected utilities. Adverse effects to existing utilities are not anticipated.

Cultural Resources

Affected Environment

The Henry Hollister House (also known as the Jesse Brunson Place) is located on the CUF Reservation and immediately adjacent to the proposed CC plant. This property includes a ca. 1850 house and historic cemetery, but only the Hollister House is listed in the National Register of Historic Places (NRHP). Three sites that are potentially eligible for listing are located within or immediately adjacent to the potential CC site. Surveys have identified 24 archaeological sites in the pipeline corridor, three of which are potentially eligible for listing in the NRHP.

Environmental Consequences

Vibrations during demolition would not adversely affect historic properties on the CUF Reservation. Based on the current siting of the CC plant, physical effects to the archaeological sites would be avoided. The construction and operation of the CC plant would result in an adverse visual effect to the Henry Hollister House. Under a Memorandum of Agreement (MOA) between TVA and the Tennessee State Historic Preservation Office (TN SHPO), TVA will take several actions to mitigate the adverse effects on the Hollister House. Additionally, archaeological sites have been identified within the proposed pipeline corridor. To fulfill obligations under Section 106 of the National Historic Preservation Act, FERC will consult with the TN SHPO and federally recognized Indian tribes on their respective actions regarding specific effects to cultural resources along the pipeline corridor. TVA will also consult with the TN SHPO and federally recognized Indian tribes on pipeline-related actions that occur on TVA property.

Solid and Hazardous Waste

Affected Environment

The primary solid wastes that result from the operation of CUF are CCRs in the form of ash and gypsum. In Tennessee, CCRs require special waste approval for the wastes to be disposed of at a landfill specifically permitted to receive those types of wastes (Class I or II disposal facility). CUF is considered a small quantity generator of hazardous waste by TDEC and a small quantity handler of universal waste.

Environmental Consequences

Demolition and construction debris would be generated during the demolition of the coal plant components. Direct effects would be minor due to the limited potential for hazardous waste to be discharged and/or released into the environment during demolition activities. The proposed construction activities of the CC plant would result in a potential increase in generation of hazardous waste. TVA would manage all solid and hazardous wastes in accordance with applicable state regulations and TVA BMPs. Spill

Prevention Control and Countermeasure (SPCC) plans would be implemented to minimize the potential of a spill during construction and operation of the pipeline.

Safety

Affected Environment

Public emergency services in the vicinity of the CUF Reservation include law enforcement services and fire protection services in Cumberland City, as well as urgent care clinics and a hospital in the city of Erin. Public emergency services in the pipeline area include urgent care clinics, hospitals, law enforcement services, and fire protection services.

Environmental Consequences

TVA's Standard Programs and Processes related to safety would be strictly adhered to. These safety programs and processes are designed to identify actions required for the control of hazards in all activities, operations, and programs. They also establish responsibilities for implementing Section 19 of the Occupational Safety and Health Act of 1970. TVA and its contractors are required to comply with applicable regulations and follow a Site-Specific Safety & Health Plan.

The greatest potential safety hazard in pipeline construction would be a fire that could result in the event of a major pipeline rupture or leak. The proposed pipeline will be designed in accordance with U.S. Department of Transportation (USDOT) regulations (49 CFR 192) for material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion. All pipe is anticipated to be USDOT Pipeline and Hazardous Material Safety Administration Class 1, 2, or 3 rated, as required. If a safety hazard does occur, this may result in increased strain on local emergency services.

Proper planning, adherence to applicable regulations and health and safety plans, and implementation of BMPs, will minimize the potential for Alternative A-related safety and public health effects.

Socioeconomics

Affected Environment

The CUF labor market area, which includes counties in Tennessee and Kentucky, and the pipeline corridor socioeconomic study area, which includes census tracts in Tennessee, are largely rural. From 2010 to 2020, population growth was generally less than the growth for the associated states. Based on the 2015-2019 American Community Survey (ACS) 5-year estimates, the populations were generally more aged and had fewer high school graduates or higher academic level than the overall state populations. Housing units were generally owner-occupied and newer than those from across the states. The study areas generally had higher unemployment rates and lower per capita income when compared to the associated states. Manufacturing and healthcare generally led the industries for employment in both study areas, with education services employing large percentages, as well. Each study area exceeded state percentages for civilians employed in transportation, manufacturing, and utilities.

As of June 2021, CUF directly employed 252 people with average annual salaries approximately 125 percent higher than the average annual wages across the CUF labor market area. CUF also employs contractors for both short- and long-term operations

support and contracts with coal and limestone mining operations and transportation companies that support additional employment and contributions to the area economy. Indirect and induced effects on the local economy associated with CUF occur through sales, income, and employment in the region and the recirculation of money received through direct and indirect income sources and subsequent creation of new jobs and economic activities.

Environmental Consequences

With CUF retirement, contracts associated with coal operations and indirect and induced economic activities would be canceled or cease. The 252 people currently employed by CUF, approximately nine percent of the total employment in Stewart County, may become temporarily unemployed. TVA would help offset this loss by placing some interested employees in available positions across the TVA region. Current CUF employees may also find alternative employment in local industries. However, based on the 2019 ACS, the median earnings for full-time employment in these other industries are approximately $16,000 to $29,000 less on average than in the utilities industry. CUF employees and associated family members may also temporarily relocate for work or follow recent depopulation trends and permanently relocate outside the CUF area, and these changes may affect familial and community relations in the CUF labor market area. The retirement of the CUF coal facilities may result in indirect employment effects to the associated mining, trucking, and barge industries and likewise affect familial and community relations in the region from which these CUF products are purchased.

Employment in relation to construction and operations of the new CC plant and the natural gas pipeline and associated gas system infrastructure would be new temporary and permanent employment options in the CUF labor market area and in the pipeline corridor socioeconomic study area. About 50 percent of the construction workforce would be sourced locally, which would have a net positive effect on the local economy. Approximately 25 to 35 of the existing operational personnel at CUF could remain to operate and maintain the new CC plant.

Noise

Affected Environment

Noise generating sources in the vicinity of the project site include boat traffic, routine vehicle operations at the project site, and the existing coal facility. Sensitive noise receptors in the vicinity of the CUF Reservation include residences and recreational areas, as well as the historic Hollister House. Sensitive noise receptors in the vicinity of the proposed pipeline include residences and recreational areas.

Environmental Consequences

Temporary noise effects would occur from the demolition of the coal plant and construction of the CC plant and related pipeline and transmission lines. Noise effects from construction-related traffic are expected to be temporary and minor. After the construction of the pipeline, there would be little to no noise during its operation aside from occasional maintenance activities, including the periodic mowing of the pipeline ROW.

Visual Resources

Affected Environment

Except for CUF and the other industrial plants southeast of CUF, the surrounding region is largely undeveloped with residential and commercial development in the vicinity of Cumberland City to the east and Erin to the south. The overall scenic value class for the affected environment ranges from poor within the plant facility to good in the surrounding area. The proposed CC plant site is an area of common scenic attractiveness, as the site contains viewscapes comparable to the surrounding area. The viewscape of the proposed pipeline corridor is largely pre-disturbed open space, elements associated with the adjacent transmission line, and forest.

Environmental Consequences

Most of the deconstruction actions, aside from the demolition of the stacks, are not expected to be discernible due to the screening effects of terrain and overall distance, nor would they contrast with the overall landscape. The proposed CC plant would generally be absorbed by surrounding industrial components and would become visually subordinate to the overall landscape character associated with the plant site. While most of the pipeline would not be visible once buried and operational, its cleared, maintained corridor would cause long-term visual effects in previously forested areas.

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ACRONYMS AND ABBREVIATIONS

Acronym	Description
AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officia
AC	Alternating Current
ACM	Asbestos Containing Material
AJD	Approved Jurisdictional Determination
ANSI	American National Standards Institute
ARAP	Aquatic Resources Alteration Report
ATWS	Additional Temporary Workspace
BA	Biological Assessment
BACT	Best Available Control Technology
BESS	Battery Energy Storage System
BG	Block Group
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
BO	Biological Opinion
CAA	Clean Air Act
CC	Combined Cycle
CCR	Coal Combustion Residuals
CCVT	Capacitor-controlled Voltage Transformer
CCS	Carbon Capture and Sequestration
CCW	Closed Cooling Water
CEMC	Cumberland Electric Membership Corporation
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRM	Cumberland River Mile
CT	Combustion Turbine
CUF	Cumberland Fossil Plant
CWA	Clean Water Act
D4	Decommissioning, Deactivation, Decontamination, and Demolitior
DC	Direct Current
DEIS	Draft Environmental Impact Statement
DER	Distributed Energy Resources
DO	Dissolved Oxygen
DOJ	Department of Justice
DR	Demand Response
EA	Environmental Assessment
EE	Energy Efficiency
EIS	Environmental Impact Statement
EJ	Environmental justice

Acronym	Description
ELG	Effluent Limit Guidelines
EMA	Emergency Management Agency
EMF	Electromagnetic Field
EO	Executive Order
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAL	Fish and Aquatic Life
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FGD	Flue Gas Desulfurization
FHWA	Federal Highway Administration
FIDVR	Fault Induced Delayed Voltage Recovery Phenomenon
FPPA	Farmland Protection Policy Act
FY	Fiscal Year
gal/d/mi^2	Gallons per Day per Square Mile
GHG	Greenhouse Gas
GIS	Global Information System
GPM	Gallons per Minute
GPS	Global Positioning System
GWP	Global Warming Potential
HAP	Hazardous Air Pollutants
HDD	Horizontal Directional Drilling
HOV	High Occupancy Vehicle
HRSG	Heat Recovery Steam Generator
HUC	Hydrologic Unit Code
HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
IDL	Industrial Landfill
IMP	Internal Monitoring Point
IRP	Integrated Resource Plan
IRR	Irrigation
IWG	Interagency Working Group on Social Cost of Greenhouse Gases
IWS	Industrial Water Supply
JCT	Johnsonville Combustion Turbine Plant
kV	Kilovolt
LAER	Lowest Achievable Emission Rate
LCEA	Life Cycle Emissions Analysis
LEP	Limited English proficiency
L_{eq}	Equivalent sound level
LF	Linear Foot
LOLE	Loss of Load Event

Acronym	Description
LOS	Level of Service
LPC	Local Power Companies
LWW	Livestock, Watering, and Wildlife
MATs	Mercury and Air Toxics Standards
MBTA	Migratory Bird Treaty Act
MCL	Method Control Limit
MMBtu	Million British Thermal Units
MGD	Million Gallons per Day
MLEC	Meriweather Lewis Electric Cooperative
MLV	Mainline Valve
MMT	Million Metric Tons
MRDS	Mineral Resources Data System
MVA	Megavolt Amperes
MW	Megawatt
MWh	Megawatt-hour
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standard for Hazardous Air Pollutants
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NLCD	National Land Cover Dataset
NO_x	Oxides of Nitrogen
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NPV	Net Present Value
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NRI	National Rivers Inventory
NRTS	Naturally Reproducing Trout Stream
NSPS	New Source Performance Standard
NWI	National Wetland Inventory
OHGW	Overhead Ground Wire
OPGW	Fiber-Optic Ground Wire
ORL	Owner Requested Limit
O-SAR	Office-Level Sensitive Area Review
OSHA	Occupational Safety and Health Administration
PAB	Palustrine Aquatic Bottom Wetland
PCB	Polychlorinated Biphenyl
PEM	Palustrine Emergent Wetland
PFO	Palustrine Forested Wetland
PHMSA	Pipeline and Hazardous Materials Safety Administration

Acronym	Description
PJD	Preliminary Jurisdictional Determination
PM	Particulate Matter
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
ppm	Parts per Million
PSA	Power Service Area
PSD	Prevention of Significant Deterioration
PSS	Palustrine Scrub Shrub Wetland
PTE	Potential to Emit
PURPA	Public Utility Regulatory Policies Act
PV	Photovoltaic
RACT	Reasonably Available Control Technology
RBI	Reservoir Benthic Index
RBLC	Reasonably Available Control Technology, Best Available Control Technology/Lowest Achievable Emission Rate Clearinghouse Database
RCRA	Resource Conservation and Recovery Act
REC	Recreation
RFAI	Reservoir Fish Assemblage Index
RFFA	Reasonably Foreseeable Future Actions
RICE	Reciprocating Internal Combustion Engines
RM	River Mile
RNHD	TVA Regional Natural Heritage Database
RO	Reverse Osmosis
ROD	Record of Decision
ROW	Right-of-Way
SAIPE	Small Area Income and Poverty Estimates
SCADA-RTU	Supervisory Control and Data Acquisition Remote Terminal Unit
SC-GHG	Social Cost of Greenhouse Gases
SCR	Selective Catalytic Reduction
SERVM	Strategic Energy and Risk Valuation Model
SHPO	State Historic Preservation Office
SI	Spark Ignition
SO_2	Sulfur Dioxide
SPCC	Spill Prevention Counter Measure and Control Plan
SVC	Static VAR Compensator
SWDA	Solid Waste Disposal Act
SWPPP	Stormwater Pollution Prevention Plan
TCP	Traditional Cultural Properties
TDC	Traditional Cultural Property
TDEC	Tennessee Department of Environment and Conservation
TDOA	Tennessee Division of Archaeology
TDOT	Tennessee Department of Transportation
TDS	Total Dissolved Solids

Acronym	Description
TENORM	Technology Enhanced Naturally Occurring Radioactive Material
TGP	Tennessee Gas Pipeline Company, LLC
TL	Transmission Line
TN AAQS	Tennessee Ambient Air Quality Standards
TRDA	Loudon- Tellico Reservoir Development Agency
TRAM	Tennessee Rapid Assessment Method
TRM	Tennessee River Mile
TSCA	Toxic Substances Control Act
TS	Trout Stream
TSS	Total Suspended Solids
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
UDP	Unanticipated Discoveries Plan
USACE	U.S. Army Corps of Engineers
USBLS	U.S. Bureau of Labor Statistics
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEIA	U.S. Energy Information Administration
USEPA	U.S. Environmental Protection Agency
USET	United South and Eastern Tribes, Inc.
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
WCMES	Weakly County Municipal Electric System
WOUS	Waters of the United States

GLOSSARY

Aeroderivative Combustion Turbine – Highly efficient peaking units that can ramp up very quickly to provide capacity and grid support when needed. Aero CTs operate like a jet engine where the compressor draws air into the unit, compressing it, mixing it with fuel, and igniting it. As combustion occurs, gas expands through turbine blades connected to a generator to produce electricity. Aero CTs are different from simple-cycle CTs as they provide high cycling capability and very fast startup.

Aqueous Ammonia System – A system that delivers aqueous ammonia using vaporizers (electric hot air or steam heat) to generate ammonia. Aqueous ammonia is considered a safer delivery system than systems using anhydrous ammonia, an extremely hazardous material.

Battery Energy Storage Systems (BESS) – Devices that store energy from the grid and renewable sources, typically during periods of surplus power or low demand.

Best Management Practice (BMP) – Practices chosen to minimize environmental effects to a variety of environmental resources. BMPs are typically standard practices and not customized for a particular proposed action.

Capacity Credit – The percentage of nameplate capacity that is counted as firm, dispatchable capacity for meeting peak load requirements.

Capacity Factor – The ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full power operation during the same period.

Carbon Capture and Sequestration – A process that involves capturing manmade carbon dioxide (CO_2) at its source and storing it permanently underground.

Coal Combustion Residual (CCR) – Ash and residuals from the flue gas desulfurization process (e.g., synthetic gypsum) produced by the combustion of coal to generate electricity.

Combined Cycle (CC) Plant – An electrical generating unit consisting of a natural gas-fired turbine and generator, a heat recovery steam generator that produces steam from the hot exhaust gases from the turbine, and a secondary turbine and generator powered by the steam.

Combustion Turbine (CT) Plant – An electrical generating unit fueled by either natural gas or oil consisting of a turbine and generator. CT plants can quickly begin generating electricity and are usually used to meet peak needs in power demand. Their efficiency is lower than that of CC plants. CT plants are also known as simple cycle plants to better distinguish them from combined cycle plants.

Cultural Resource – Resources may include historic buildings, structures, sites or objects, archaeological resources, Native American burials, funerary objects, sacred items, and other historic resources.

Cumulative Effect – Effects or impacts on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (federal or non-federal) or person undertakes the actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Cycling – Short term and often large changes in the amount of electricity that a generating unit produces. The swinging of the generation load from high to low.

D4 – Decommissioning, Deactivation, Decontamination, and Demolition.

Deactivation (reroute and sever) - The process of removing energy sources from the structures to be demolished.

Decommissioning - The performance of activities required to ready a facility for deactivation, decontamination, and demolition

Decontamination - Involves removing regulated materials, wastes, and chemicals prior to demolition.

Demolition - Removal of the plant and associated equipment and structures. Demolition also includes site restoration, creating conditions for proper site drainage, and stabilization.

Direct Effect – Effects or impacts which are caused by the action and occur at the same time and place.

Dispatchable Resource – Generating units whose electrical output can be adjusted (turned on or off) by operators according to system needs (electricity demand), unlike non-dispatchable renewable energy sources, such as solar photovoltaic or wind power. Can also include demand-side Demand Response products, which can be used for limited periods of time to reduce system load at peak hours.

Distributed Energy Resources (DER) –Small-scale unit of power provided by resources, such as solar, storage, wind, and combined heat and power, that are typically smaller in capacity than utility-scale and can be aggregated together in a program to function as a larger resource. They are typically owned by non-utility entities, such as homeowners (for rooftop solar) and commercial and industrial facilities.

Endangered Species – Plants or animals that are in danger of extinction through all or a significant portion of their ranges and that have been listed as endangered by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures outlined in the Endangered Species Act and its implementing regulations (50 CFR 424).

Environmental Assessment (EA) – An environmental assessment (EA) is prepared for a proposed action not qualifying as a categorical exclusion (CE) to determine whether an environmental impact statement (EIS) is necessary or a finding of no significant impact (FONSI) can be prepared. An EA concisely communicates information and analyses about issues that are potentially significant and reasonable alternatives.

Environmental Impact Statement (EIS) – An environmental impact statement (EIS) is a detailed written statement that describes a proposed action and reasonable alternatives, including no action, analyzes the potential environmental impacts associated with the proposed action, alternatives, and identifies any mitigation measures to avoid, minimize, or compensate for impacts from a proposed action.

Environmental Justice (EJ) –The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Ephemeral Stream – Rain-dependent stream that flows only after precipitation.

Federal Register – The official daily publication for rules, proposed rules, and notices of federal agencies and organizations, as well as executive orders and other presidential documents.

Firm, Dispatchable Power – Firm, dispatchable power ensures that utility companies, like TVA, can call on the generating capacity year-round, particularly during peak load events – those periods of maximum electricity demand from customers, typically late afternoon in the summer and before or around dawn in the winter. Provides a backstop for solar resources that are unable to or are very limited in their ability to meet maximum demand that occurs in the pre-daylight or early-daylight hours of the winter season.

Fault Induced Delayed Voltage Recovery (FIDVR) – The unexpected delay in the recovery of voltage to its nominal value following the normal clearing of a fault.

Flexibility – The extent to which a power system can modify electricity production or consumption in response to variability, expected or otherwise.

Floodplain – The lowland and relatively flat areas adjoining flowing inland waters and reservoirs. Floodplain generally refers to the base floodplain, i.e., that area subject to a 1 percent or greater chance of flooding in any given year.

Fugitive Dust – An air pollutant consisting of very small particles suspended in air from dispersed sources and not from a stack or duct.

Greenhouse Gas (GHG) – Gases in the atmosphere that absorb energy, slowing or preventing the loss of heat to space. Primary greenhouse gases of concern are carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Other greenhouse gases include ground-level ozone and water vapor.

Indirect Effect – Effects or impacts which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Inertia – A property of matter by which it continues in its existing state of rest or uniform motion in a straight line unless that state is changed by an external force.

Intermittent Stream – Seasonal stream that flows during certain times of the year when smaller upstream waters are flowing and when groundwater provides enough water for stream flow.

Invasive Species – An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

Inverter-Based Resource – Power generation where the inverter is supplied with direct current input and, using power electronics and control algorithms, creates an alternating current output. This type of generation is standard with solar arrays and battery storage.

Karst – An area where topography, with its characteristic erosional surface and subterranean features, is developed as the result of dissolution of limestone, dolomite, or other soluble rock. Characteristic physiographic features present in karst terrains include sinkholes, sinking streams, caves, and large springs.

Loss of Load Event (LOLE) – In the event of adverse condition or disturbance on the TVA system, or on any other system directly or indirectly interconnected with it, TVA may interrupt service to customers.

Mitigation – Measures that avoid, minimize, or compensate for the environmental impacts of an action.

Nameplate Capacity –The maximum generating output that a power plant can produce under specific conditions designated by the manufacturer.

National Environmental Policy Act (NEPA) – The federal law that establishes a national policy on the environment and requires federal agencies to consider the effects of their proposed actions on the environment before final decisions are made and involve the public in the decision making. NEPA does not mandate particular results or substantive outcomes.

National Register of Historic Places (NRHP) – A list of places and objects maintained by the National Park Service based on their integrity of location, design, setting, materials, workmanship, feeling and association, and: 1) association with important historical events; or 2) association with the lives of significant historic persons; or 3) embodiment of distinctive characteristics of a type, period, or method of construction or represent the work of a master, or have high artistic value; or 4) have yielded or may yield information important in history or prehistory.

Natural Gas Act (NGA) – A 1938 law regulating the transportation and sale of natural gas in interstate commerce and for other purposes.

No Action Alternative – The alternative that would continue with the present course of action and in which the proposed activity would not take place.

Notice of Intent (NOI) – A public notice that an agency prepares to signify beginning the preparation of an environmental impact statement.

Perennial Stream – A stream that typically has water flowing in it year-round.

Photovoltaic Power Generation – The direct conversion of light into electricity at the atomic level.

Potable Water – Water that is safe and satisfactory for drinking and cooking.

Power Purchase Agreements (PPA) – A contract between two parties, one who generates and intends to sell electricity, and one who is looking to purchase electricity, defining the commercial terms for the sale of electricity between the two parties.

Power Service Area (PSA) – The area in which TVA provides energy, an area that encompasses 80,000 square miles covering most of Tennessee and parts of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia.

Preferred Alternative – The action alternative which the agency believes would fulfill its statutory mission and responsibilities, considering economic, environmental, technical and other factors, and would meet a proposed project's purpose and need.

Prime Farmland – Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management.

Purpose and Need – A statement by an agency to describe what it is trying to achieve by proposing an action. The purpose and need statement explains why an agency action is necessary and serves as the basis for identifying the reasonable alternatives that meet the purpose and need.

Record of Decision (ROD) – The formal announcement by a federal agency, following the issuance of a final environmental impact statement, of the alternative that the agency decides to implement. It includes the reason why the agency selected the alternative, identification of the alternative with the least environmental impacts, and mitigation measures, including any enforcement and monitoring commitments, for the selected alternative.

Reliability – The degree to which the performance of the elements in a bulk system results in electricity delivered to customers within accepted standards and in the amount desired.

Reserve Margin Target - Capacity carried for unplanned events related to weather, load forecast error, and system performance. Currently, TVA's summer reserve margin target is 18 percent and winter reserve margin target is 25 percent.

Reserve Margin Study – Routine probabilistic analysis to determine appropriate reserve margin targets to ensure resource adequacy for serving electricity demand in the Tennessee Valley service territory. It considers the uncertainty of unit availability, transmission capability, weather-dependent unit capabilities (e.g., hydro, wind and solar), economic growth, and weather variations to compute expected reliability impacts and costs. TVA selects planning reserve margins for summer and winter that target an industry best-practice standard of one loss of load event (LOLE) in 10 years.

Rotating Generator – A device that converts mechanical rotation into direct current electric power using electromagnetism.

Shipper - An entity (person, company, or agency) that purchases services with respect to the transmission of natural gas by way of a natural gas transmission pipeline from the owner or operator of the pipeline, whether or not the gas is transported for the entity's own use.

Stability – The ability to return to normal or stable operation after having been subjected to some form of disturbance.

Selective Catalytic Reduction (SCR) – A clean air system used to reduce nitrogen oxides.

Surcharge – Adding rock or dirt to structure footing.

Threatened Species – Any plants or animals that are likely to become endangered species within the foreseeable future throughout all or a significant portion of their ranges and which have been listed as threatened by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures set out in the Endangered Species Act and its implementing regulations (50 CFR 424).

Title V (of the Clean Air Act) – Title V of the Clean Air Act requires states to establish an air operating permit program for stationary sources that exceed major source thresholds, which are dependent on the attainment status of the area. The permits required by these regulations are often referred to as Title V permits.

Wetland – An area inundated by surface or ground water with a frequency sufficient to support, and that under normal circumstances does or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

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CHAPTER 1 – PURPOSE AND NEED FOR ACTION

Following the publication of the Tennessee Valley Authority (TVA) 2019 Integrated Resource Plan (IRP) (TVA 2019a), TVA conducted end-of-life evaluations of its operating coal-fired generating plants not already scheduled for retirement to inform long-term planning. The TVA IRP Executive Summary (Appendix A) details near-term actions, such as increasing flexibility and evaluating end-of-life dates for aging fossil units, as well as key drivers that will influence future actions, such as electricity demand, natural gas prices, regulations, and emerging technologies. As a part of this analysis, the IRP analyzed multiple strategies with a variety of portfolios and the future of the region under each scenario, as summarized in the IRP Executive Summary. As a part of this analysis, future risks to TVA's energy portfolio were evaluated. This evaluation confirmed that the aging TVA coal fleet is among the oldest in the nation and is experiencing deterioration of plant condition and performance challenges. The performance challenges are projected to increase because of the coal fleet's advancing age and the difficulty of adapting fleet generation to the changing generation profile of the TVA system as a whole. This changing generation profile includes more rapid fluctuations in power generation and availability due to the integration of increasing generation by intermittent renewable resources, including utility-scale and distributed renewable resources, and other factors. The continued long-term operation of some of TVA's coal plants is contributing to environmental, economic, and reliability risks.

The Cumberland Fossil Plant (CUF) is the largest plant in the TVA coal fleet and is a significant contributing factor to these risks.

CUF is situated on a 2,388-acre reservation on the Cumberland River at its confluence with Wells Creek (Figure 1.1-1). The CUF reservation is located in Cumberland City, Stewart County, Tennessee, approximately 22 miles southwest of Clarksville. The two-unit, coal-fired steam-generating plant has a summer net generating capacity of 2,470 megawatts (MW).

CUF was built between 1968 and 1973. Frequent cycling of the large super-critical units has become necessary as a result of the evolution of TVA's generating fleet (primarily driven by additions of nuclear, gas, and renewable resources over the past 10-to-15 years), which is a recent change in plant operation for which the plant was not originally designed, presents reliability challenges that are difficult to anticipate and expensive to mitigate. As TVA continues to transition the rest of its fleet to cleaner and more flexible technologies, CUF will continue to be challenged to reliably operate outside of baseload operations. Based on this analysis, TVA has developed planning assumptions for CUF retirement. These assumptions include the Proposed Action of retiring both CUF units and the addition of at least 1,450 MW of firm, dispatchable generation to replace the generation capacity lost from retirement of one of the CUF units, which is in-line with the recommended MW additions and subtractions in the TVA IRP. Replacement generation of this capacity will allow TVA to replace the dependable capacity of the first unit as well as account for modest load increases driven by residential growth from higher Valley in-migration paired with slightly higher industrial load. The replacement generation would need to be online prior to retirement of the first CUF unit in 2026. Planning for the replacement generation for the second retired CUF unit would be deferred to allow consideration of a broader range of replacement generation alternatives depending on system needs and the state of technology at the time replacement is needed.

The purpose of the Proposed Action is to retire and decommission the two coal-fired CUF units by 2026 (first unit) and by 2028 (second unit) and implement replacement generation that can supply 1,450 MW of firm, dispatchable power by the time the first unit is retired in 2026. The Proposed Action to retire CUF and pursue an alternative power generation source would provide cost-effective replacement generation, consistent with the 2019 IRP and near-term future TVA energy production goals. This is consistent with the need established by the 2019 IRP to establish new capacity in the TVA region, increase reliability and flexibility, and increase energy efficiency, as well as meeting near-term future TVA energy production goals. The EIS evaluates the potential environmental effects associated with the proposed retirement and demolition of two CUF units and addition of replacement generation for one of those retired units.

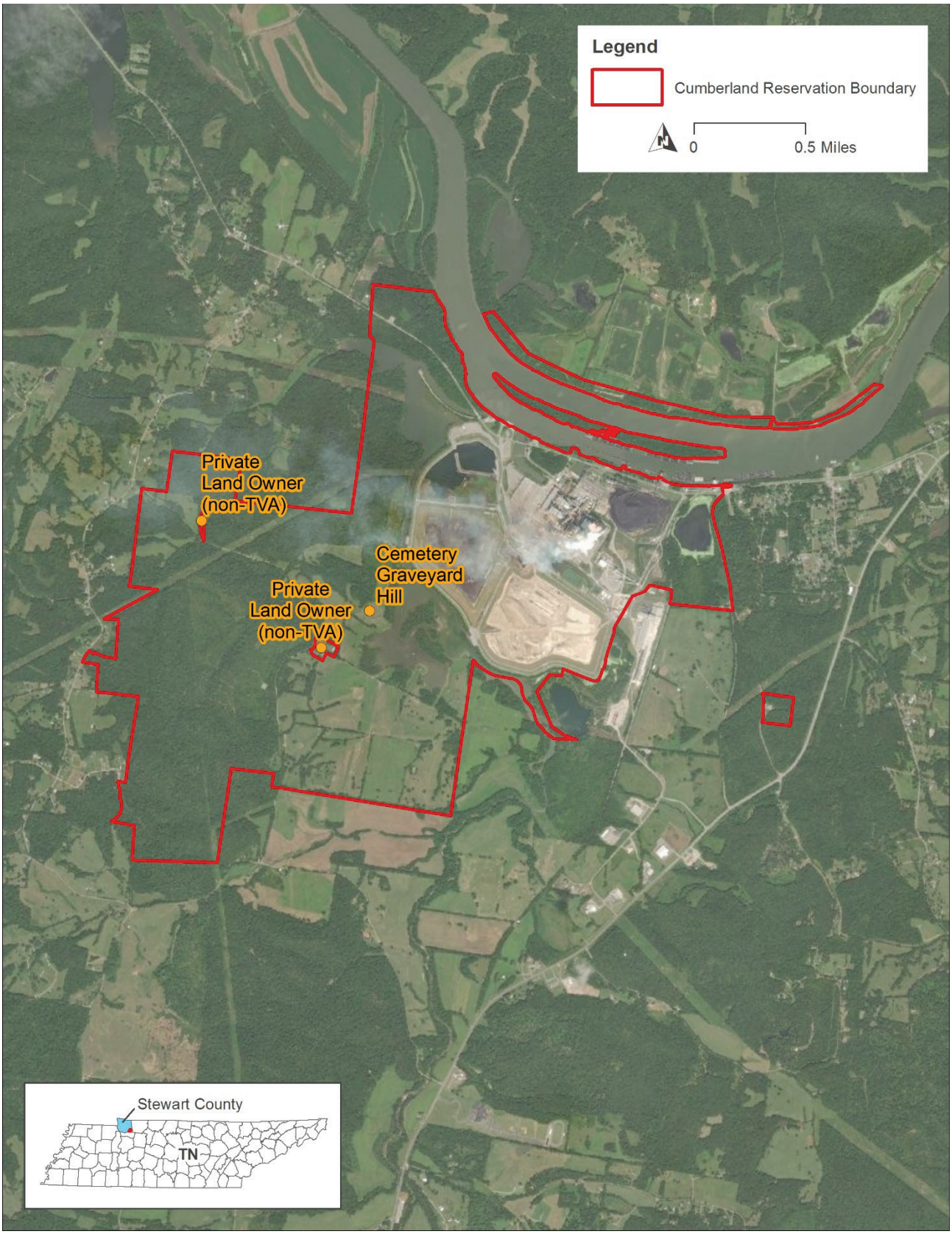

Figure 1.1-1. Cumberland Fossil Plant Reservation

1.1. Background

TVA's core statutory objectives under the Tennessee Valley Authority Act are to provide the people of the Tennessee Valley with low-cost and reliable electricity, environmental stewardship, and a prosperous economy (16 U.S.C. §§ 831 et seq.). Consistent with, and as mandated by the Act, TVA engages in a long-range, "least-cost planning" process that "evaluates the full range of existing and incremental resources (including new power supplies, energy conservation and efficiency, and renewable energy resources) in order to provide adequate and reliable service to electric customers of [TVA] at the lowest system cost" (16 U.S.C. § 831m-1(b)(1)).

To accomplish an optimal blending of diversified capacity resources to meet the Tennessee Valley's future demand for power, this least-cost system planning approach is leveraged to develop a robust, stakeholder-informed IRP. The IRP serves as the central mechanism in establishing TVA's overall asset strategy. The least-cost planning occurs through the IRP process, which evaluates, based on the entire system, ranges of MW additions and subtractions that are consistent with TVA's least-cost planning mandate. See Appendix A at ES-3. Projects within the ranges identified in the IRP are consistent with TVA's system-wide least-cost planning.

TVA conducts the IRP process in a transparent, inclusive manner, using input from a diverse group of stakeholders and the public to help shape the IRP. TVA typically updates its IRP every four to five years (2011, 2015, 2019) to ensure that its power system adapts to changing demands and regulations.

In June 2019, TVA published the 2019 IRP (TVA 2019a), a comprehensive study of how TVA can best meet the future energy demand in its power service area, which encompasses approximately 80,000 square miles covering most of Tennessee and parts of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia. It evaluated six scenarios (plausible futures) and five strategies (potential TVA responses to those futures) and identified a range of potential energy resource additions and retirements. In its development of the 2019 IRP, TVA noted that the emissions of air pollutants, intensity of greenhouse gas emissions, and generation of coal waste decrease under all strategies upon the utilization of a target power supply mix. The TVA Board thus recommended the use of a target power supply mix. The target power supply mix identified the addition of up to 500 MW of demand response and 2,200 MW of energy efficiency (demand-side options); 4,200 MW of wind; 5,300 MW of storage; 8,600 MW of combustion turbines (CT); 9,800 MW of combined cycle (CC); and 14,000 MW of solar by 2038. The target power supply mix recommended in the IRP optimizes TVA's ability to create a more flexible power-generation system that can successfully integrate increasing amounts of renewable energy sources while ensuring reliability.

Additionally, the 2019 IRP recommended a series of near-term actions, including evaluating engineering end-of-life dates for aging fossil units to determine whether retirements greater than 2,200 MW would be appropriate, to inform long-term planning. A subsequent Aging Coal Fleet Evaluation (TVA 2021k) considered whether the complete retirement of TVA's coal fleet, about 6,000 MW in total, should be expedited beyond the 2,200 MW of coal capacity retirement by 2038 that was identified in the target power supply mix of the IRP. The operating cost and reliability challenges posed by the aging coal fleet drove the need for the Aging Coal Fleet Evaluation. Additional drivers for conducting the Aging Coal Fleet Evaluation include:

- Substantial performance and cost risk from operating a coal fleet composed of some of the oldest plants in the nation;
- Public, political, regulatory and marketplace pressures and TVA goals to reduce coal generation and its environmental impacts;
- Integration of increasing amounts of intermittent, renewable resources and distributed resources, which drives the need for increased system flexibility;
- Long-term financial health of the coal mining industry, which could influence both the supply and price of coal; and
- Development of a plan to systematically replace coal plants reaching the end of their useful lives, allowing for more effective and proactive management of the financial, logistical, and workforce impacts.

The Aging Coal Fleet Evaluation (TVA 2021k) concluded that a phased plan to retire TVA's coal fleet by approximately 2035 is aligned with least-cost planning and reduces economic, reliability, and environmental risks. The evaluation also recommended specific planning assumption retirement dates for each of the coal plants to facilitate the 2035 end-of-life timeline. These assumed retirement dates were identified based on a high confidence of execution while also balancing economics and system reliability needs.

The strategic direction established by the 2019 IRP, and results from recommended near-term actions, formed the basis for TVA's Asset Strategy, which continues to support affordable, reliable, and cleaner energy for customers. The action alternatives evaluated in this EIS are one aspect of the overall asset strategy blending a combination of resource technologies including:

- Maintaining the existing low-cost, carbon-free nuclear and hydro fleets;
- Retiring aging coal units as they reach the end of their useful life, expected by 2035;
- Adding 10,000 MW of solar by 2035 to meet customer demands and system needs, complemented with storage;
- Using natural gas-fueled generation to enable needed coal retirements and solar expansion as other technologies develop;
- Leveraging demand-side options, in partnership with local power companies (LPCs); and
- Partnering to develop new carbon-free technologies for greater reduction in carbon emissions.

The inclusion of natural gas-fired CTs and CCs in the target power supply mix is driven by the demand for reliable electricity, the amount of solar penetration, system firm capacity requirements, commodity prices, costs relative to alternative resource options, and transmission system reliability. TVA's target power supply mix requires firm, dispatchable power, which refers to a resource that can adjust power output up or down on demand within resource-specific operating limitations (e.g., natural gas-fired CC and CT units can be operated year-round to meet system demand needs, including overnight, during cold pre-dawn winter mornings, and during warm summer evenings as solar generation fades). Unlike firm, dispatchable resources, solar resources are typically only available on average about 25 percent of the year, and their availability can vary significantly during daylight

hours as cloud cover and precipitation events occur. As such, solar power must be paired with firm, dispatchable power or battery storage to meet year-round capacity needs. Battery storage pairing is constrained in that batteries are energy limited (e.g., 4-hour duration) and are net consumers of electricity. Pairing solar with flexible, firm, dispatchable resources provides a backstop to ensure system reliability is maintained during the hours that solar resources are not available, and during daylight hours when solar resources may quickly ramp up or down in response to local weather conditions. The inclusion of firm, dispatchable power generation from, for example, natural gas-fired CTs and CCs, effectively enables system-wide integration of solar and the retirement of TVA's remaining coal plants while providing critical transmission-related benefits to ensure reliability and power quality.

A key beneficial result of TVA's Asset Strategy is the reduction in carbon emissions. As TVA implements the Asset Strategy, and as articulated in TVA's May 2021 Strategic Intent and Guiding Principles document (TVA 2021j), system carbon intensity will decrease by 70 percent from a 2005 baseline by 2030. From this strategy, TVA also envisions a path to ~80 percent carbon reduction by 2035 and aspires to net-zero carbon emissions by 2050, while continuing to provide affordable and reliable power for customers. These goals are consistent with the climate goals of the United States (as detailed in EO 14008 and EO 14082) to reduce GHG emissions 50–52 percent below 2005 levels in 2030 and achieve net zero emissions by no later than 2050. They also make significant advancements towards meeting the current Administration's objective of achieving a carbon-free electric sector by 2035 to the extent this objective is compatible with the mandates of least-cost planning and other provisions of the TVA Act requiring TVA to take into account diversity, reliability, dispatchability, resiliency, and other related factors.

While the recently enacted Inflation Reduction Act (IRA; Public Law No: 117-169) may improve pricing and availability for renewable and storage resources in the long term, the actual effect of that legislation on these markets is unknown at this time. TVA is optimistic that the legislation will enable faster adoption of renewable resources on TVA's system in the long term. Relevant to this EIS, while the provisions of the IRA provide substantial incentives for various forms of clean energy, for a number of reasons, those provisions are of limited applicability with respect to the generation choice decisions confronting TVA that are the subject of this EIS.

For example, the tax incentive provisions of the IRA are likely to take more time to implement than is available to TVA for purposes of choosing replacement energy for the Cumberland Fossil Plant that must be in place by 2026. The Treasury Department must issue guidance to establish certain qualifications and processes for tax incentive provisions, which could take up to a year, if not longer. Generally, taxpayers do not make firm commitments with respect to projects that are substantially dependent upon tax incentives until such final implementation rules are issued. To meet the needed 2026 timeframe, TVA cannot wait until the Treasury Department's rulemaking process plays out to select a replacement power alternative.

As another example, the main renewable energy generation sources, wind and solar, are intermittent resources requiring substantial energy storage capacity to "firm" their reliability in order for them to be considered as a substitute for a dispatchable resource. The IRA includes significant tax incentives for energy storage, perhaps most significantly, extending the section 48 investment tax credit to energy storage technology. Notwithstanding this credit, energy storage technology remains very expensive compared to TVA's Preferred

Alternative. For example, the US Energy Information Administration's (EIA) 2022 Annual Energy Outlook includes estimated levelized costs for new generation resources. EIA's estimated levelized cost for a new combined cycle plant entering service in 2027 is $37.05/MWh (capacity-weighted), as compared to $123.84/MWh for a battery storage system. (Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022 (eia.gov)). While the values quoted from EIA's 2022 Annual Energy Outlook were published prior to the passage of the IRA, it should be noted that while a 30 percent investment tax credit will be helpful it does not fundamentally alter TVA's least cost planning determinations in this case. Further, the current supply chain issues could erode at least some of the financial benefits otherwise accruing from those tax credits.

In any event, even with the long-term benefits that are expected from the IRA, substantial transmission assets would need to be developed for Alternative C. That legislation would not affect the transmission-related time constraints described below for Alternative C impair the ability of this alternative to fully meet TVA's purpose and need of firm, dispatchable generation by the end of 2026. As such, the IRA will not alter the fundamental need for flexible, fast-ramping generation, and for inertia service and primary frequency response, of the type provided by Alternative A. (See also, Letter from Tennessee Valley Public Power Association, Inc. to Tennessee Valley Authority, September 30, 2022)

Thus, the IRA does not alter TVA's selection of the preferred alternative (Alternative A) nor does it change the system-wide least-cost planning analysis that led to TVA's adoption of the target supply mix in the 2019 IRP. To the extent that the IRA improves pricing and availability for renewable resources over the next several years, TVA's next IRP, which it will initiate no later than 2024, will account for the relevant IRA benefits in its system-wide least cost planning analysis. *See* Appendix Q, Concentric Report, p. 25.

The potential environmental effects of implementing the IRP were the subject of an accompanying programmatic EIS (TVA 2019b). Subsequent decisions on individual energy resources are the subject of separate environmental reviews that tier from the IRP EIS. This EIS tiers from the 2019 IRP programmatic EIS and builds on its findings with site-specific analyses for the generating resources under consideration, to the extent currently practicable.

Consistent with the 2019 IRP, the Aging Coal Fleet Evaluation, and the Strategic Intent and Guiding Principles, the purpose of the Proposed Action is to retire and decommission the two coal-fired CUF units by 2026 (first unit) and by 2028 (second unit), and implement replacement generation that can supply 1,450 MW of firm, dispatchable power by the time the first unit is retired in 2026. The need for the Proposed Action is to ensure that TVA can meet required year-round generation and maximum capacity system demands and planning reserve margin targets, particularly during peak load events.

1.1.1. Retirement of Aging Coal Units

The results of the Aging Coal Fleet Evaluation (TVA 2021k) confirmed that TVA's coal fleet is among the oldest in the nation and is experiencing material condition and performance challenges typical for plants approaching the end of their useful lives. Age-driven issues are difficult to proactively address and can result in unplanned or extended unavailability of these units, which may increase costs and could impact overall system reliability if coal-fired plants are unavailable at times of high system loads. Due to the TVA coal fleet's lack of "fit" with TVA's overall portfolio, TVA would need to operate the coal units outside of their intended design for traditional baseload operations (i.e., near the full power output for many

weeks or months at a time). For example, increases in baseload nuclear generation and expansion of intermittent solar generation require Cumberland's large, typically baseload-serving coal units to operate more flexibly, such as ramping power output up and down throughout the day or cycling on and off more frequently, outside of traditional baseload operations. Because the coal fleet no longer fits TVA's overall portfolio, the coal fleet is projected to experience increasing performance challenges, which would continue to add economic, reliability, and environmental risk to the system.

1.1.2. Timing Needs for Coal Unit Retirement and Replacement Generation

Based on TVA's Aging Coal Fleet Evaluation, TVA identified planned retirement dates that would advance the overall purpose of the 2019 IRP of achieving the optimal blend of energy resources to meet TVA's clean energy transition goals in a manner consistent with least-cost planning principles. Retirement dates were determined for the entire coal fleet based on relative material condition, cost, flexibility, and environmental impacts. TVA's evaluation determined that retiring the coal fleet in phases by 2035 achieved the best balance between economics and system reliability, while allowing for a prudent path of execution.

To meet TVA's phased 2035 retirement plans for the coal fleet, the 1,450 MW of replacement generation needed to replace the first retiring unit at Cumberland must be operational before the first Cumberland unit is retired in 2026. If this replacement generation is not in place it would leave TVA short on required generation and capacity to meet system demands and planning reserve margin targets. Delay in implementation of the 1,450 MW of replacement generation likely would lead to the continued operation of the Cumberland coal unit for some period of time. If the first Cumberland unit must stay in operation beyond 2026, significant investment would be required to maintain safe and reliable operations and comply with environmental regulations (see Section 8.2.6 of the 2019 IRP). Operation beyond 2026 would also inject operational risk back into the TVA system due to the deteriorating condition of the coal units. In addition, operation of the Cumberland unit(s) beyond 2026 and 2028, respectively, likely would result in cascading delays for the later planned retirements in TVA's phased 2035 coal fleet retirement plan and could delay TVA's plans to integrate more solar assets into the system.[1]

1.1.3. Firm, Dispatchable Power

In order to implement the target power supply mix recommended by the 2019 IRP to create a more flexible power generation system that can successfully integrate increasing amounts of renewable energy sources while ensuring reliability, the 1,450 MW of replacement generation needed to replace the first retiring unit at Cumberland must include firm, dispatchable power. Because the capacity from the first CUF unit is firm, dispatchable

[1] The DEIS presented an extended retirement range of December 31, 2026 but no later than December 31, 2030 for the first CUF unit, and December 31, 2028 but no later than December 31, 2033 for the second CUF unit. The later dates identified in the DEIS were based on contingency retirement dates that TVA identified could result if events outside of TVA's control (e.g., delays in construction timelines, lack of contractor workforce) require short-term extension of the Cumberland coal unit operation and likely would result in the delays and challenges discussed in this section (e.g., cascading delays for the later planned retirements in TVA's phased 2035 coal fleet retirement plan, delays to TVA's plans to integrate more solar assets into the system). Accordingly, TVA is clarifying in the FEIS that the purpose and need of this action is to retire and decommission two coal-fired CUF units by 2026 (first unit) and 2028 (second unit), respectively, and implement replacement generation that can supply 1,450 MW of firm, dispatchable power by the time the first unit is retired in 2026.

power, and to retain all the attributes of that power on the system, including the ability to adjust power output up or down on demand, the replacement generation must also be firm, dispatchable power to reliably meet system peak load demands. Firm, dispatchable power ensures that TVA can call on the generating capacity year-round, particularly during peak load events, i.e. those periods of maximum electricity demand from customers, typically late afternoon in the summer and before or around dawn in the winter. This is particularly critical in the winter because firm, dispatchable generation provides a backstop for solar resources that are unable to or are very limited in their ability to meet maximum demand that occurs in the pre-daylight or early-daylight hours.

Pairing solar resources with the appropriate level battery storage can compensate for this deficiency but adds cost and introduces transmission stability and reliability issues that then must be addressed with transmission system improvements. TVA's transmission system, particularly in geographic areas with high loads near Nashville and Knoxville, relies on coal units to provide adequate local generation, and their rotating generators ensure voltage stability is maintained. Inverter-based resources, e.g., solar and battery storage, lack rotating generators and therefore do not provide the dynamic reactive or inertia support needed to maintain reliability in those areas. Alternatives that seek to leverage inverter-based resources as a replacement for the generation and capacity of a resource that includes a rotating generator must be paired with significant transmission investment to maintain transmission system stability and reliability. The scope and complexity of the required transmission investments for inverter-based resource alternatives add cost and risk relative to alternatives that include rotating generators and require more time to complete those projects.

1.2. Decision to be Made

TVA prepared this EIS to evaluate the environmental and social effects of the proposed retirement and demolition of the two CUF units and the addition of at least 1,450 MW of replacement generation. In addition to the No Action Alternative, this EIS evaluates three alternatives for replacing the generation lost as a result of retiring one CUF unit:

A. Retirement and demolition of CUF and construction and operation of a combined cycle combustion turbine (CC) gas plant at the same site;

B. Retirement and demolition of CUF and construction and operation of simple cycle combustion turbine (CT) gas plants at two alternate locations; and

C. Retirement and demolition of CUF and construction and operation of solar generation and energy storage facilities, at alternate locations primarily in Middle Tennessee.

Connected actions, such as construction of a natural gas pipeline and transmission system upgrades, are also considered in this assessment.

1.3. Related Environmental Reviews and Other Documentation

Related environmental documents and materials relevant to this assessment are listed below. The contents of these documents help describe the affected properties and are incorporated by reference as appropriate.

1.3.1. TVA Integrated Resources Plan and EIS (July 2019)

The 2019 IRP programmatic EIS (TVA 2019b) evaluated the potential effects of TVA's long-term IRP, which provides direction on how TVA can best meet future electricity demand. The 2019 IRP evaluated six scenarios (plausible futures) and five strategies (potential TVA

responses to those futures) and identified a range of potential resource additions and retirements throughout the TVA power service area.

1.3.2. TVA Aging Coal Fleet Evaluation (May 2021)

This evaluation was performed to recommend near-term retirement planning assumptions to reflect practical timelines for replacement generation. The first draft of the evaluation was completed during Fiscal Year (FY) 2020, with refinements made in May 2021.

1.3.3. Fossil Plant Ash Impoundment Closure (June 2016)

This programmatic EIS evaluated the closure of ash impoundments containing Coal Combustion Residuals (CCRs) at fossil fuel plants across the Tennessee Valley to support the implementation of TVA's goal to eliminate all wet CCR storage at its coal plants.

1.3.4. Cumberland Fossil Plant Borrow Areas and Access Road (August 2017)

This environmental assessment (EA) evaluated the development of a new access road and onsite borrow sites at CUF to support ongoing operations, including partial closure of the fly ash and gypsum stacks, in accordance with TDEC regulations.

1.3.5. Cumberland Fossil Plant Coal Combustion Residuals Management Operations (April 2018)

This EIS evaluated the construction and operation of a bottom ash dewatering facility, an onsite CCR landfill, and process water basins at CUF.

1.3.6. Cumberland Fossil Plant Wastewater Treatment Facility (July 2019)

This EA evaluates the environmental consequences of the proposed construction and operation of a new wet flue gas desulfurization wastewater treatment system at CUF.

1.3.7. Johnsonville Aeroderivative Combustion Turbine Project (July 2022)

TVA issued the final EA and Finding of No Significant Impact (FONSI) for the Johnsonville Aeroderivative Combustion Turbine project in Humphreys County, Tennessee in July 2022. TVA proposed the addition of 10 natural gas-fired aeroderivative CTs at the Johnsonville Reservation.

1.4. Scoping and Public Involvement

1.4.1. Public Involvement for the 2019 IRP and Programmatic EIS

1.4.1.1. Public Scoping

Public involvement was a particular focus throughout the IRP development process. After publishing a Notice of Intent (NOI) for the 2019 IRP and Programmatic EIS in the Federal Register, TVA then sent the NOI to local and state government entities and federal agencies; issued a news release to media; and posted the news release on the TVA website. TVA also sent 2,500 scoping notices to agencies, organizations, and the public, including those on the 2015 IRP mailing list and people who registered to receive additional information on the TVA IRP website. TVA also published notices regarding the NOI and scoping period in local newspapers, including the following cities and associated newspapers:

- Chattanooga, Tenn. – Chattanooga Times Free Press
- Huntsville, Ala – The Huntsville Times
- Memphis, Tenn. – The Commercial Appeal

- Nashville, Tenn. – The Tennessean
- Knoxville, Tenn. – Knoxville News Sentinel
- Paducah, Ky – Paducah Sun
- Bowling Green, Ky – Bowling Green Daily News

TVA held two public meetings and a public webinar during the scoping period. The public meetings presented TVA's project objectives and initial alternatives for input from the public and interested stakeholders. Participants included the public; congressional, state and local officials; representatives from local power companies; non-governmental organizations and other special interest groups; and TVA employees. Ninety-one individuals attended the meetings in person or via webinar. At the conclusion of the public meetings and scoping period, TVA issued the 2019 IRP Scoping Report, which included copies of scoping materials and the 87 comment submissions received during the scoping period. The scoping report used public input to develop the 2019 IRP framework and to help determine which resource options should be considered. The NOI and Scoping Report for the 2019 IRP and EIS are available on TVA's Environmental Reviews website: https://www.tva.com/environment/environmental-stewardship/environmental-reviews/nepa-detail/Integrated-Resource-Plan.

1.4.1.2. IRP Working Group

The formation of an IRP Working Group was a cornerstone of the public input process for the 2019 IRP and consisted of 20 external stakeholders representing 20 organizations, eight of which represented the interests of entities purchasing power from TVA and 12 other members representing energy and environmental non-governmental organizations; research and academia with expertise in DERs; state government; economic development organizations; and community and sustainability interests. Additional details regarding the IRP working group members and affiliation are provided in Section 3.2.1 of the 2019 IRP (TVA 2019a).

1.4.1.3. Public Outreach and Briefings

TVA hosted four webinars during the IRP process to keep the public informed of the progress of the 2019 IRP and IRP EIS. Each webinar included a brief presentation by TVA staff, followed by a moderated question and answer session. During development of the IRP and EIS, TVA used social media communications (including Facebook, Twitter, LinkedIn, and Instagram) to inform and educate the public about the IRP and its processes and to promote opportunities for public input. Specific information on public outreach and the use of social media for the 2019 IRP and EIS is available in Section 3.3 of the 2019 IRP (TVA 2019a).

1.4.1.4. Public Review of Draft IRP and EIS

TVA also worked to reach a broader, more diverse cross section of the public to ensure awareness about the 2019 IRP and to provide opportunities for making comments. TVA sought input from existing partners who serve diverse communities regarding the methods that would be most successful in reaching a broader diversity of people. Generally, the input received suggested that working through groups and entities that have existing relationships with various diverse communities would be the most successful way to achieve this. Given this input, TVA sought to join existing events where people of greater diversity already were engaged. TVA also provided the draft IRP and EIS for public comment and held public meetings around the region to provide an opportunity for

residents and stakeholders to learn more about the draft IRP and EIS, ask questions, and provide general feedback. Over 1,200 people commented on the draft IRP and Draft EIS (DEIS). Comments were grouped into six categories and then TVA provided responses to those comments in an appendix (Appendix F) to the IRP Final EIS (FEIS). Additional information and details on the public review of the draft IRP and EIS is provided in Section 3.4 of the 2019 IRP (TVA 2019a).

1.4.2. Public Involvement for the Cumberland Retirement EIS

1.4.2.1. Scoping and Notice of Intent for the CUF Retirement EIS

TVA initiated a 30-day public scoping period on May 11, 2021, when it published the NOI in the *Federal Register* announcing plans to prepare an EIS for the retirement of CUF and construction and operation of facilities to replace part of the retired generating capacity (TVA 2021a). In the NOI, TVA requested comments on other reasonable alternatives that should be assessed in the EIS. The purpose of the scoping period was to present TVA's project objectives and initial alternatives for input from the public and interested stakeholders.

In addition to the NOI published in the *Federal Register*, TVA invited members of the public, as well as federal, state, and local agencies and federally recognized Indian tribes, to comment on the scope of the EIS. Project-specific information and a news release (TVA 2021b) were listed on TVA's website at www.tva.com/nepa, including a link to a virtual public scoping meeting room and an online public comment page. TVA published notices regarding the NOI in local newspapers, including the following cities and associated newspapers:

- Dover, Tenn. – Stewart County Standard and Houston County Herald
- Clarksville, Tenn. – The Leaf-Chronicle

1.4.2.2. Public Scoping Meeting

A virtual public scoping meeting was held on May 27, 2021, from 5:30 pm to 7:00 pm CDT. The virtual meeting room was hosted online for the duration of the scoping period and provided navigation to the following materials: welcome board and video, project purpose and need, project alternatives overview map and detailed maps of each alternative, overview of the National Environmental Policy Act (NEPA) compliance process and scoping, a form to submit comments, information on the virtual scoping meeting, and links to other related websites. The virtual meeting room also contained text-accessible versions of the content.

The meeting was attended by 28 members of the public, regulatory agencies, and other organizations. TVA used questions and comments submitted prior to and during the virtual public meeting to develop a list of Frequently Asked Questions, which has been posted onto the TVA's CUF Retirement EIS website (TVA 2021b). In accordance with Section 1318.402(h) of TVA's NEPA regulations, a scoping report was developed and includes information about NEPA, federal and local laws, and executive orders (EOs) that are relevant to this EIS. The scoping report (TVA 2021c) was made available to the public on the TVA project website (Cumberland Fossil Plant Retirement EIS - Scoping Report (tva.com)) and presents the public comments received, as well as information on how the EIS is being developed. A summary of comment submissions and TVA responses is provided in the scoping report; comment submissions were compiled and provided in Appendix C of the scoping report (Cumberland Fossil Plant Retirement EIS - Scoping

Report Appendices (tva.com)); and where relevant, TVA's responses to the comments are incorporated into this EIS.

1.4.2.3. Scoping Feedback

During the EIS scoping period, TVA received approximately 830 comments, including comments from two federal agencies, one state agency, six non-governmental organizations, and members of the public, including landowners potentially affected by the proposed natural gas pipeline associated with Alternative A. Most of the comments resulted from a form letter campaign organized by the Sierra Club. Comments received during the scoping period were related to the alternatives under consideration, land use, prime farmland, water resources, biological resources, greenhouse gas (GHGs) emissions, cultural resources, socioeconomic and environmental justice effects, and cumulative effects.

After the conclusion of the public scoping period, TVA sent a postcard update to residences within a two-mile radius of the Cumberland, Johnsonville, and Gleason Reservations, as well as to landowners within Dickson County who requested to be added to TVA's mailing list. TVA also distributed informational flyers to clients of the Highland Rim Economic Corporation during a commodity distribution event to provide notice of the upcoming DEIS comment period and potential public involvement events.

Based on internal and public scoping, identification of applicable laws, regulations, EOs, and policies, TVA identified the resource areas listed below as requiring review within the EIS:

- Land use and recreation
- Geology, soils, and prime farmland
- Water resources, including groundwater, wetlands and surface water, and floodplains
- Biological resources, including natural areas, vegetation, wildlife, rare, threatened, and endangered species
- Visual resources
- Noise
- Air quality and emissions of greenhouse gases (GHGs)
- Cultural resources
- Utilities
- Waste management
- Public and occupational health and safety
- Transportation
- Socioeconomics
- Environmental justice

No other environmental resources were identified during the scoping process that TVA has determined should be addressed in detail in this EIS.

1.4.2.4. Public and Agency Review of the Draft EIS

The DEIS was posted on TVA's website and notice of its availability was provided on April 25, 2022. EPA's Notice of Availability of the DEIS was published in the Federal Register on April 29, 2022, initiating a 45-day public comment period that ended on June 13, 2022. In addition, notification of availability of the DEIS was announced in regional and local newspapers, and a news release was issued to the media and posted to TVA's web site. TVA's agency involvement included sending letters to local, state, and federal agencies and federally recognized tribes to notify them of the availability of the DEIS. TVA contacted local officials and leaders, schools, and community action organizations in and around the Cumberland Plant. TVA partnered with the Highland Rim Economic Corporation to identify potential environmental justice populations and distributed information regarding availability of the DEIS. TVA also provided a pizza party and distributed coloring books with project information/factsheets to Tennessee Ridge Elementary School and Stewart County Middle School in the Spring of 2022 advertising the public comment period and public meetings.

Utilizing TVA's internal Customer Analytics group, notification of the public meetings was sent to all environmental justice community addresses within 3 miles of the CUF plant. Notification of the DEIS public comment period and public meetings was also published in local newspapers. TVA held three public meetings for the DEIS:

- Virtual Public Meeting, May 12, 2022
- Public Meeting, Cumberland City, Tenn., May 17, 2022
- Public Meeting (EJ Focused), Erin, Tenn., May 18, 2022

TVA accepted comments submitted through mail, email, a comment form on the public website, and in person at the public meetings. TVA provided hard copies of the DEIS to four individuals at their request. TVA also provided hard copies of the DEIS to three libraries surrounding the CUF Plant, including:

- Montgomery County Public Library, 350 Pageant Lane, Suite 501 Clarksville, Tenn.
- Stewart County Public Library, 102 Natcor Drive, Dover, Tenn.
- Houston County Public Library, 24 S. Spring St., Erin, Tenn.

TVA received 770 comments and 930 signatures on the DEIS; most of these generally supported the retirement of the CUF Plant but opposed Alternative A, Alternative B, or both. About three-fourths of these comments were submitted through the web-based comment form. Several form emails generated by multiple environmental groups were also submitted, including the Clean Up TVA Coalition, Sierra Club, Southern Environmental Law Center (SELC), and Southern Alliance for Clean Energy (SACE). A list of commenters, their affiliation, and reference to comment response number(s) addressing their comments is provided in Part C of Appendix O. A few comments were received on subjects outside the scope of the DEIS, such as health insurance and pensions for retired plant workers. The out-of-scope comments are not included in this report.

TVA carefully reviewed all of the substantive comments that it received. Many of the individual comments were similar in substance. To avoid repetition, TVA grouped similar comments and produced one synthesized response for each comment grouping. The commenters contributing to each synthesized comment are listed in Part B of Appendix O. Because TVA was careful not to lose nuances among comments, a number of synthesized

comments have common features and there is some overlap. The result of this analysis and synthesis process is the list of 118 substantive comments for which TVA has provided responses in Appendix O.

A few comments stated a general support for the continued use of coal to generate electricity; these were interpreted as supporting the No Action Alternative, under which TVA would continue to generate electricity with the existing CUF coal-fired Units. Multiple commentors indicated support for the retirement of CUF and replacing generation with either Alternative A or Alternative B. Comments were received from two federal agencies (U.S. Environmental Protection Agency [USEPA] and National Park Service [NPS]) and two state agencies (Tennessee Department of Environment and Conservation [TDEC] and Tennessee Department of Transportation [TDOT]). In their comments on the DEIS, USEPA requested to participate in the preparation of the FEIS as a cooperating agency. TVA has had further discussions with the USEPA, and incorporated their comments as appropriate. TVA also approved the USEPA request to be a cooperating agency.

1.5. Necessary Permits, Licenses, and Consultations

TVA holds the permits necessary for the current operation of CUF. A summary of the laws and executive orders relevant to the Proposed Action is provided in Table 1.5-1.

Table 1.5-1. Laws and Executive Orders Relevant to the Proposed Action

Environmental Resource Area	Law / Executive Order
Geology, Soils, and Prime Farmland	Farmland Protection Policy Act
Water Resources	Administrative Code of Tennessee 69-3-108 Administrative Code of Tennessee Department of Environment and Conservation (TDEC), Chapter 0400-04 CWA Sections 401, 402, and 404 EO 11988 – Floodplain Management EO 11990 – Protection of Wetlands EO 13778 – Restoring the Rule of Law, Federalism, and Economic Growth by Reviewing the “Waters of the U.S.” Rule EO 14008 – Tackling the Climate Crisis at Home and Abroad Safe Drinking Water Act TDEC Aquatic Herbicides General Permit
Biological Resources	Administrative Code of TDEC, Chapter 0400 Bald and Golden Eagle Protection Act Endangered Species Act (ESA) Section 7 (Consultation with U.S. Fish & Wildlife Service) EO 13112 – Invasive Species EO 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds Migratory Bird Treaty Act (MBTA) EO 14008 – Tackling the Climate Crisis at Home and Abroad
Air Quality and GHG Emissions	Clean Air Act (CAA)

Environmental Resource Area	Law / Executive Order
	EO 13990 - Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis EO 14008 – Tackling the Climate Crisis at Home and Abroad EO 14057 - Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability Administrative Code of TDEC – Chapter 1200-3 and Chapter 0400-30
Cultural Resources	Administrative Code of Tennessee, Chapter 0400.02 Archaeological Resources Protection Act (ARPA) National Historic Preservation Act (NHPA) Section 106 Native American Graves Protection and Repatriation Act
Waste Management	Administrative Code of Tennessee, Chapter 0400.10-12 Comprehensive Environmental Response, Compensation, and Liability Act Emergency Planning and Community Right-to-Know Act (EPCRA) Resource Conservation and Recovery Act (RCRA) Solid Waste Disposal Act (SWDA) Toxic Substances Control Act (TSCA)
Public and Occupational Health and Safety	Occupational Safety and Health Act
Environmental Justice	EO 12898 – Federal Actions to Address Environmental Justice in Minority and Low-Income Populations EO 14008 – Tackling the Climate Crisis at Home and Abroad

To implement the proposed action, TVA would have to maintain, obtain, or seek amendments to the following permits that are already in place at CUF:

- Tennessee Stormwater Multi-Sector General Permit for Industrial Activities: TNR051933
- Solid Waste Class II Disposal Permits from TDEC
- National Pollutant Discharge Elimination System (NPDES) permit: TN0005789
- Air permits for emissions
- CUF Gypsum Disposal Complex and Dry Ash Stack CCR Landfill – IDL 81-102-0086
- CUF – Proposed Cumberland Fossil Plant CCR Landfill – IDL 81-000-0222 (Pending)
- CUF Special Waste Permits
- CUF – Division of Water Resources Permits (TNR191811, TNR191752, TNR191734, TNR191725, TNR191704, TNR051933

Necessary permits would be evaluated based on site-specific conditions. Other potential permits or requirements relevant to the proposed action are identified in Table 1.5-2.

Table 1.5-2. Potential Permits Relevant to the Proposed Action

Submittal	Agency	Authorization	Applicability	Timing	Notes/ Assumptions
CWA 404/401 Permitting	U.S. Army Corps of Engineers (USACE) Nashville District	Section 404 Nationwide Permit	Effects to Wetlands & Waters (<0.5-acre)	45 days	Pre-Construction Notification may be required; mitigation may be required
		Section 404 Individual Permit	Effects to Wetlands & Waters (≥0.5-acre)	12 months. Typically, contingent on 401 Certification	Mitigation required
	TDEC DWR	Section 401 Water Quality Certification (ARAP)	Effects to Tennessee State Waters & Wetlands	12 months	Mitigation may be required for effects; requires pre-filing or clearing notice 30 days prior to submission
CWA 402 NPDES Permitting	TDEC DWR – NPDES Stormwater Permitting Program	Section 402 General Permit for Stormwater Discharges Associated with Construction Activities	Stormwater discharges from activities ≥1 acre of disturbance during construction	Notice of intent and stormwater pollution prevention plan (SWPPP) to be filed 30 days prior to construction	Early coordination recommended; NOI and SWPPP for Construction Activity – Stormwater Discharges. If granted, Permit TNR100000 would authorize discharges associated with construction activities that result in a total land disturbance of 1 acre or greater.
CWA 402 NPDES Permitting (con't)	TDEC DWR – NPDES Discharge Permit	Clean Water Act (33 U.S.C. 1251 et seq.)	Persons discharging pollutants directly from point sources into surface waters of the state. Direct dischargers include industrial and commercial wastewater, industrial stormwater, and municipal wastewater	6-12 months	The Division must make permit decisions within one (1) year of receipt of a complete application for major facilities and within 180 days of receipt of a complete application for minor facilities.

Submittal	Agency	Authorization	Applicability	Timing	Notes/ Assumptions
			discharges.		
Encroachment and Crossing Permits	TDOT	Rules and Regulations for Accommodating Utilities within Highway Rights-of-Way (ROW), Chapter 1680-6-1 TDOT 2018)	Aboveground or below ground installation within state, federal-aid metro-urban, or State-aid highway system road ROWs	30-day review time	N/A
	USDOT	U.S. Department of Transportation's Highway/Utility Guide (USDOT 1993)	Aboveground or below ground installation within U.S. highway ROWs	30-day Review time	N/A
Protected Species Coordination	USFWS	MBTA; ESA Section 7 Consultation	Federally listed endangered and threatened species / Migratory Birds	Varies, minimum of 30 days	Initial consultation letters issued (05/04/22), concurrence received (07/20/22)
Cultural Resources Coordination	Tennessee Historical Commission	NHPA Section 106 Consultation	Cultural Resources	30-day review time	Initial State Historic Preservation Office (SHPO) and tribal consultation letters were issued (07/29/21). Consultation concluding with the signing of a MOA (07/22/2022) for potential effects to NRHP-listed Hollister House. FERC is continuing consultation with the TN SHPO and federally recognized Indian tribes on its actions regarding specific effects to cultural resources along the pipeline corridor.

1.6. Environmental Impact Statement Overview

NEPA requires federal agencies to consider the environmental effects of their proposed actions in their decision-making. Actions, in this context, can include new and continuing activities that are conducted, financed, assisted, regulated, or approved by federal agencies, as well as new or revised plans, policies, or procedures. The NEPA review process is intended to ensure federal agencies consider the environmental effects of their actions in the decision-making process (40 CFR Parts 1500–1508). NEPA also requires that federal agencies provide opportunities for public involvement in the decision-making process.

This EIS was prepared in accordance with NEPA (42 U.S. Code [U.S.C.] §§ 4321 et seq.); the regulations implementing NEPA promulgated by the Council on Environmental Quality (CEQ; 40 Code of Federal Regulations [CFR] §§ 1500–1508, 1515-1518, as updated July 16, 2020); and TVA NEPA regulations and procedures (18 CFR §§ 1318). Further, the EIS is consistent with the CEQ finalized rule amending certain provisions of its 2020 regulations (87 FR 23453, April 20, 2022).

TVA has prepared this EIS to assess the environmental effects of the Proposed Action. TVA used the input from the public scoping period, summarized in Section 1.4, in developing the DEIS. Following the 45-day public comment period for the DEIS, TVA carefully reviewed the comments on the DEIS, conducted additional analyses, and prepared this FEIS. TVA's responses to the comments on the DEIS are presented in Appendix O.

Transmission and electrical system upgrades required under the alternatives are reviewed in this EIS. The description of the anticipated effects of system upgrades required under each alternative presented in Chapter 3 is based on the best information available during the preparation of the EIS. If TVA determines, as a result of continuing analyses, that the upgrades are likely to result in adverse effects and need mitigation measures outside the range of those described in this EIS, TVA will conduct further reviews on those aspects of the Proposed Action.

Under Alternative A, Tennessee Gas Pipeline Company, L.L.C. (TGP), a subsidiary of Kinder Morgan, would construct and operate a 32-mile natural gas pipeline pursuant to an agreement with TVA[2]. TGP submitted a request to use the pre-filing procedures to the Federal Energy Regulatory Commission (FERC or "the FERC") under Docket No. PF22-2-000; the request was granted by FERC in November 2021 (TGP 2021). TGP filed a Certificate Application with FERC on July 22, 2022 (Docket CP22-493).

The pipeline requires approval by FERC, which is the lead federal agency for authorizing interstate natural gas transmission facilities under the Natural Gas Act and the lead federal agency for preparation of the environmental analysis for the proposed pipeline in accordance with NEPA. TVA is treating the proposed pipeline as a related action under TVA's Alternative A and is evaluating the pipeline in detail in this FEIS. The description in the DEIS of the environmental setting and likely environmental impacts of the pipeline was largely based on a desktop review of the proposed pipeline using GIS-based and publicly available information. Since the publication of the DEIS, TGP has conducted extensive

[2] TVA has entered into a precedent agreement with TGP. A precedent agreement between a transporter and shipper of natural gas is a preliminary agreement to enter into a future firm gas transportation agreement if certain conditions are met.

field-based surveys and assessments of the various environmental resources potentially affected by the pipeline. TVA has incorporated the information contained in these assessments in the relevant sections of this FEIS using information from the Resource Reports prepared by TGP that were submitted to FERC. These Resource Reports and other related documents and correspondence are available on the FERC website at https://elibrary.ferc.gov, under Docket No. CP22-493 and Docket No. PF22-2-000, and are also available on Kinder Morgan's website at: https://www.kindermorgan.com/Operations/Projects/cumberland-project. The environmental impacts of the construction and operation of the pipeline will also be addressed in an EIS being prepared by FERC (FERC 2022). The draft of this FERC EIS is scheduled to be published in February 2023 and the corresponding FEIS is scheduled to be published in June 2023. TVA recently moved to intervene in the FERC certification process to respond to comments FERC received on its scoping notice that are specific to TVA's proposed action.

The FEIS is posted on the TVA website and notices of its availability have been sent to those who received the DEIS or submitted comments on the DEIS. TVA sent the FEIS to the USEPA, which will publish a notice of availability in the Federal Register. A Record of Decision will be issued by TVA no sooner than 30 days after the notice of availability of the FEIS. It will include (1) the decision; (2) the rationale for the decision; (3) alternatives that were considered; (4) identification of the environmentally preferable alternative; and (5) associated mitigation measures, monitoring, and enforcement requirements.

CHAPTER 2 - ALTERNATIVES

This chapter describes the No Action, the Proposed Action of retiring and demolishing the CUF plant, and the alternatives for replacement of part of the retired generation. During initial project planning, TVA considered a range of alternatives and specific screening criteria to provide for the reliable replacement of generation currently provided by the first unit at CUF to be retired.

2.1. Description of Alternatives

This section describes the alternatives evaluated in detail in this EIS. These alternatives are:

- No Action Alternative – The CUF units would continue to operate as part of the TVA generation portfolio. Additional plant modifications would be necessary to ensure compliance with USEPA's CCR rules, effluent limitations guidelines (ELGs), and other applicable requirements.
- Alternative A – Retirement of CUF, demolition of the units and construction and operation of a CC gas plant on the CUF Reservation. Alternative A also includes construction and operation of a natural gas pipeline, to be constructed, owned, and operated by TGP pending FERC approval.
- Alternative B – Retirement of CUF, demolition of the units, and construction and operation of simple cycle CT gas plants at alternate locations.
- Alternative C – Retirement of CUF, demolition of the units, and construction and operation of solar and energy storage facilities at alternate locations primarily in Middle Tennessee.

TVA's addition of natural gas-fueled generating capacity is consistent with the planning direction in the 2019 IRP to retire coal capacity. The types of generation needed to replace the retired coal capacity is also guided by the 2019 IRP, which contemplates the addition of up to 9,800 MW of CC capacity, up to 8,600 MW of CT capacity, and up to 14,000 MW of solar capacity, by 2038. The target supply mix adopted by the TVA Board in 2019 is consistent with least-cost planning obligations in 16 U.S.C. § 831m-1 and aligns with the requirement in Section 15d(f) of the TVA Act to sell power "at rates as low as feasible." All of these considerations have informed the development of the purpose and need and alternatives in this EIS. The Preferred Alternative is expected to help TVA meet the goals reflected in the Strategic Intent and Guiding Principles (May 2021) document to reduce carbon emissions 70 percent by 2030 with a path to an ~80 percent reduction by 2035, and to attain the aspiration of net-zero carbon emissions by 2050.

In sum, Alternative A (the Preferred Alternative) meets the purpose and need for this project and helps achieve TVA's system-wide goals of integrating more solar and facilitating the retirement of coal plants. While Alternatives B and C do not meet the purpose and need for this project, both are evaluated in detail in this EIS, reflecting a hard look at technologically proven alternatives, including a fully renewable replacement option (Alternative C) that is responsive to public comments received throughout the EIS process.

2.1.1. Coal Combustion Residual Activities to Occur with All Alternatives

CUF has significant future capital needs to support compliance with the USEPA CCR and ELG rules. TVA has previously conducted environmental reviews for activities necessary to comply with USEPA's CCR and ELG rules (USEPA 2018). Under the No Action Alternative and the action alternatives, TVA would implement specific actions related to wastewater treatment and the management and disposal of CCRs at CUF. CCR management projects have been previously analyzed in NEPA documents listed in Section 1.3, or are future projects, which are either underway or would start within the next five years. CCR management actions would occur if CUF continues to operate (No Action alternative) or is retired (all action alternatives).

2.1.2. The No Action Alternative

Under the No Action Alternative, TVA would not retire the two CUF units. These units would continue to operate as part of the TVA generation portfolio. For the existing units to remain operational, additional construction, repairs, and maintenance would be necessary to maintain reliability and comply with environmental regulatory requirements and to ensure compliance with applicable regulatory requirements such as the ELG guidelines and CWA Section 316b requirements, see TVA's Aging Coal Fleet Evaluation, and Section 8.2.6 of the 2019 IRP for further details. Under the No Action Alternative, TVA would not construct new replacement generation. Based on the age, material condition, and cost required to ensure reliability of CUF, this alternative does not meet the purpose and need of TVA's proposed action.

2.1.3. Alternative A - Retirement of CUF, demolition of the units, and construction and operation of a CC Gas Plant on the CUF Reservation

2.1.3.1. Retire and Demolish CUF

Following completion of construction of the proposed CC plant, one of the units at CUF would be retired by 2026. The second unit at CUF would be retired by 2028. Planning for the replacement generation for the second retired CUF unit would be deferred to allow consideration of a broader range of replacement generation alternatives depending on system needs and the state of technology at the time replacement is needed. The retired coal facilities would transition to the Decommissioning, Deactivation, Decontamination, and Demolition (D4) process as described in Table 2.1-1. Routine CUF plant deliveries would also be discontinued. The anticipated CUF demolition boundary under Alternative A is shown in Figure 2.1-1. The existing switchyard would continue to support the second unit at CUF until that unit is retired, after which the switchyard would be demolished. Employment at the plant would be reduced. All previously approved CCR management projects would continue to be implemented.

Table 2.1-1. Key D4 Activities

Decommissioning	Deactivation	Decontamination	Demolition
Tagging out all unit or plant equipment except service water, lighting, etc.	Performing electrical and mechanical isolation of systems, components, and areas	Removal and proper disposal of regulated materials	Demolition of all buildings and structures within the proposed demolition boundary to three feet below final grade via mechanical deconstruction and/or explosives
Emptying and cleaning hoppers, bins, bunkers, etc.	Installing bulkheads and/or fill tunnels	Periodic materials condition monitoring	Backfill all buildings and structures with below grade features using concrete and masonry from the demolished facilities in addition to fill

Decommissioning	Deactivation	Decontamination	Demolition
Opening all equipment electrical breakers not in use	Providing alternate power and services for sump pumps, Federal Aviation Administration (FAA) stack lighting, etc.	Periodic waste removal as materials deteriorate over time	Cut and cap all buried utilities within the project boundary and abandon in place if they do not interfere with other ongoing projects that overlap the project footprint
Draining and disposing/recycling of oil and fluids Salvaging, storing, and relocating useable equipment, components, materials, spare parts, office products, etc. Salvaging and storing all key plant records			Decommission and seal all hollow pipe utilities with a mechanical cap or plug Restore site to grade to provide proper drainage

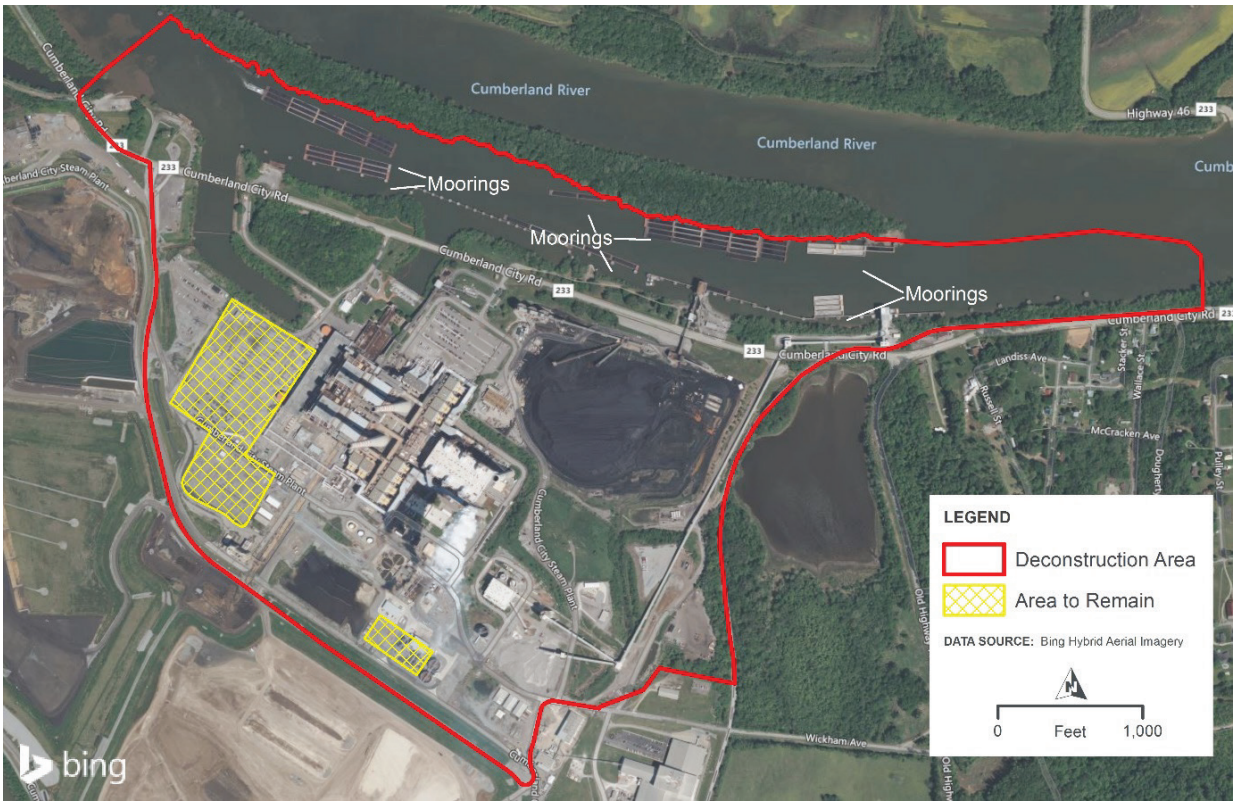

Figure 2.1-1. Map of Cumberland Fossil Plant Deconstruction Area under all Action Alternatives

Virtually all coal unit operational activities would be discontinued, and the coal plant would be demolished. All buildings, structures, conveyers, and silos associated with plant operations would be decontaminated and demolished to three feet below final grade. All below-grade building areas would be backfilled, and the site would be restored to grade while providing proper drainage. The following buildings and structures are proposed for demolition:

- Powerhouse Units 1 and 2

- Smokestacks
- Aboveground Coal Conveyors and Coal Conveyor Tunnels to three feet below final grade
- Steam Lines
- Tank Farms
- Wash Pads
- Office Wing
- Service Bay
- Utility Building
- Breaker Building
- Training Building
- Fuel/Chemical Storage and associated piping
- Railroad and crossties within the plant boundary
- Silos
- Light towers
- Scrubber Facility
- Water Treatment Plant
- Security Portal/ Guard Building
- Fire Engine Building
- Scrubber Absorber Building
- Mooring Cells
- Power Stores Buildings
- Electrical Shop
- Silo Filling House
- Surge Hopper
- Car Wash
- Ball Mill Building (Limestone Prep)
- Transformer Yard
- Precipitator Building
- Coal Barge Unloading Area, Transfer Stations, and Surge Hopper
- Waste Storage Building
- Fish Screens
- Limestone Barge Unloader and Transfer Stations
- Oil Water Separators

- Control Building
- Warehouses
- Hydrogen Ports
- Other unnamed structures within the demolition boundary

The following features are also included for consideration for deconstruction/demolition:

- Select plant roads and parking lots
- Street Lighting
- Intake Condenser Circulating Water Tunnels (bulkheading[3])
- Discharge Condenser Circulating Water Tunnels (bulkheading)
- All decommissioned piping from the tank farm (that may contain residuals) to the Utility Building, the Coal Pile, and the Tug Fueling Station
- Coal Conveyor Tunnels and Transfer Pits to 3 feet below final grade (facilities below 3 feet would be abandoned in place)
- Dock Service Building
- Rotary Car Dumper and associated railroad track, ties, and ballast
- Sanitary Sewer Connections from Demolished Facilities
- Plant Perimeter Fencing
- Water Treatment Building and Reverse Osmosis (RO) Trailers
- RO Plant
- Demineralization Plant

The following buildings and facilities located within the Deconstruction Area will remain in place and operational at CUF:

- Intake Pump Station
- Barge Unloader
- Booster Fan Building
- Draft Sys XFMR YD Transformer
- Diesel Fire Pump House
- Existing 161-kV and 500-kV switchyards and all associated insulating oil piping and pit (indicated by yellow cross hatching in Figure 2.1-1)[4]
- FGD Wastewater Treatment system

[3] Bulkheading consists of installing an engineered seal, potentially constructed of concrete, flowable fill or other barrier material for the purpose of preventing water intrusion.
[4] The existing switchyards would continue to support the existing second unit at CUF until that unit is retired, after which the switchyards would be demolished.

Primary operational activities that would be discontinued include daily coal barge operations, coal pile management, pumping and use of water from the Cumberland River for the coal plant, and thermal discharges from the coal plant back into the Cumberland River. The combustion of coal for the production of power would cease, as would generation of wastes associated with such power production.

2.1.3.2. Construction and Operation of a New CC Plant

A CC power plant uses a natural gas CT and a steam turbine together to produce up to 50 percent more electricity from the same fuel than a traditional simple-cycle (i.e., without a steam turbine) CT plant. The waste heat from the gas turbine is routed to the heat recovery steam generator (HRSG). The steam from the HRSG then goes to the nearby steam turbine, which generates extra power (GE Gas Power 2021). A typical CC plant configuration is illustrated in Figure 2.1-2.

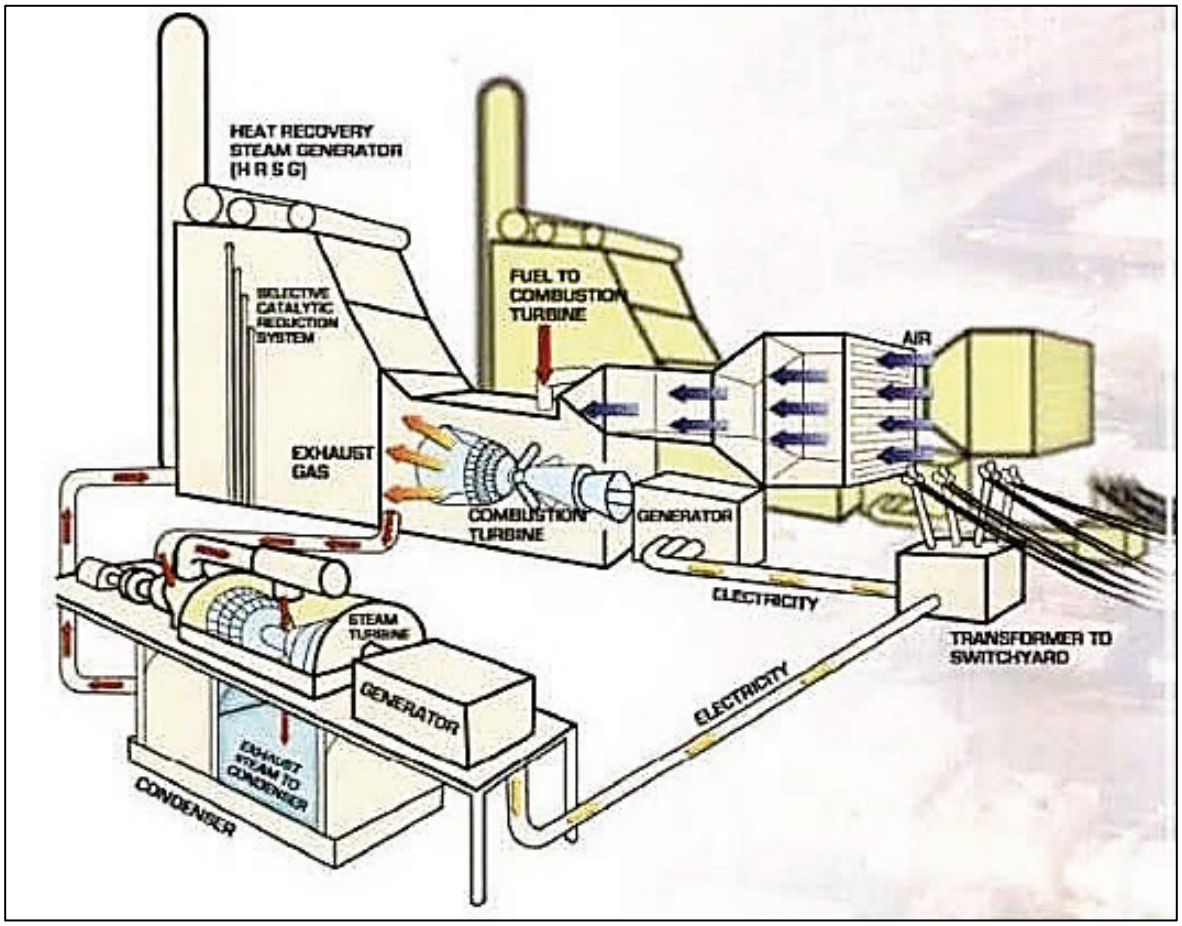

Figure 2.1-2. Typical Components of a CC Power Plant

2.1.3.2.1. Site Evaluation for New CC Plant

TVA identified candidate sites for the proposed location of a new CC plant based on a desktop review of land parcels located near existing transmission access, existing natural gas supply, and with direct access to large quantities of water for steam and cooling operations. Initial site screening resulted in several potential locations for a new CC plant, including other facility reservations within the TVA system. These sites were then further evaluated using the criteria summarized in Table 2.1-2.

Table 2.1-2. Summary of Criteria Evaluated to Determine the Location of the CC Plant

Transmission	Site Considerations	Operational Considerations
• System upgrades needed • Locational value	• TVA vs non-TVA owned sites • Site availability (available for purchase) • Land cost • Access to water	• Supply chain considerations • Staffing
Fuel Supply	**Environmental Considerations**	**Financial and Planning Considerations**
• Cost • Availability • Reliability • Operational considerations	• Environmental regulations • Sensitive environmental/cultural resources present • Water discharge considerations and potential regulations	• TVA's Long Range Financial Plan • TVA's Integrated Resource Plan

Based on evaluation of the screening criteria, TVA proposes to construct a new CC plant of approximately 1,450 MW generating capacity on the 2,388-acre Cumberland Reservation. This location offered several benefits:

- The construction footprint for the new CC plant could be located on land within existing TVA property as opposed to purchasing property.
- The Cumberland Reservation currently includes transmission interconnection to the TVA system, which can be repurposed for the new plant and would not require extensive network upgrades to support area voltage and stability. This would not only reduce costs and impacts to interconnect the new plant but would largely eliminate costs and impacts associated with potential transmission upgrades required following coal plant retirement.
- While there is not currently natural gas service to the Cumberland Reservation, it is approximately 32 miles from a major interstate pipeline with adequate capacity to service a new CC plant. Additionally, the proposed route for the new pipeline lateral is generally located along an existing TVA transmission line (TL) corridor, reducing potential environmental effects.
- This brownfield location has favorable air permitting prospects for a new CC, since it will be replacing higher emitting coal units.

TVA proposes to construct a CC plant on the Cumberland Reservation and performed a screening evaluation for three potential plant sites within the reservation. Option A1 was eliminated due to its proximity to an existing TL, its inability to meet Project timeline, and insufficient acreage. Option A3 was eliminated due to the extensive clearing of mature trees

and grading that would be necessary at this site. Option A2 (Figure 2.1-3), which covers approximately 277 acres, was identified as the preferred location for the proposed CC plant on the Cumberland Reservation.

Option A2 was further refined by TVA to minimize impacts to the greatest extent feasible. This revised impact boundary can be seen in Figure 2.1-4 and encompasses a total of 195.86 acres. Of this acreage, 55.84 acres are referred to as Permanent (Fill) as a result of the CC Plant construction (51.18 acres) and the barge unloading facility (4.66 acres); 91.25 acres are referred to as Permanent (Habitat Conversion) as a result of TL upgrades; and the remaining 48.78 acres are temporary use areas for construction laydown and equipment storage during the construction period. The Alternative A analyses in Chapter 3 focus on the refined layout illustrated in Figure 2.1-4.

Alternative A also includes proposed improvements to the existing barge unloading facility identified in Figure 2.1-3 and 2.1-4, which would consist of grading and creation of dirt/rock ramping to the nose of the barge as well as potential concrete resurfacing and widening. The existing barge unloading area would continue to serve as a public boat ramp after construction is complete. The improvements would largely benefit public recreation, as TVA would only utilize the unloading area on scheduled delivery days.

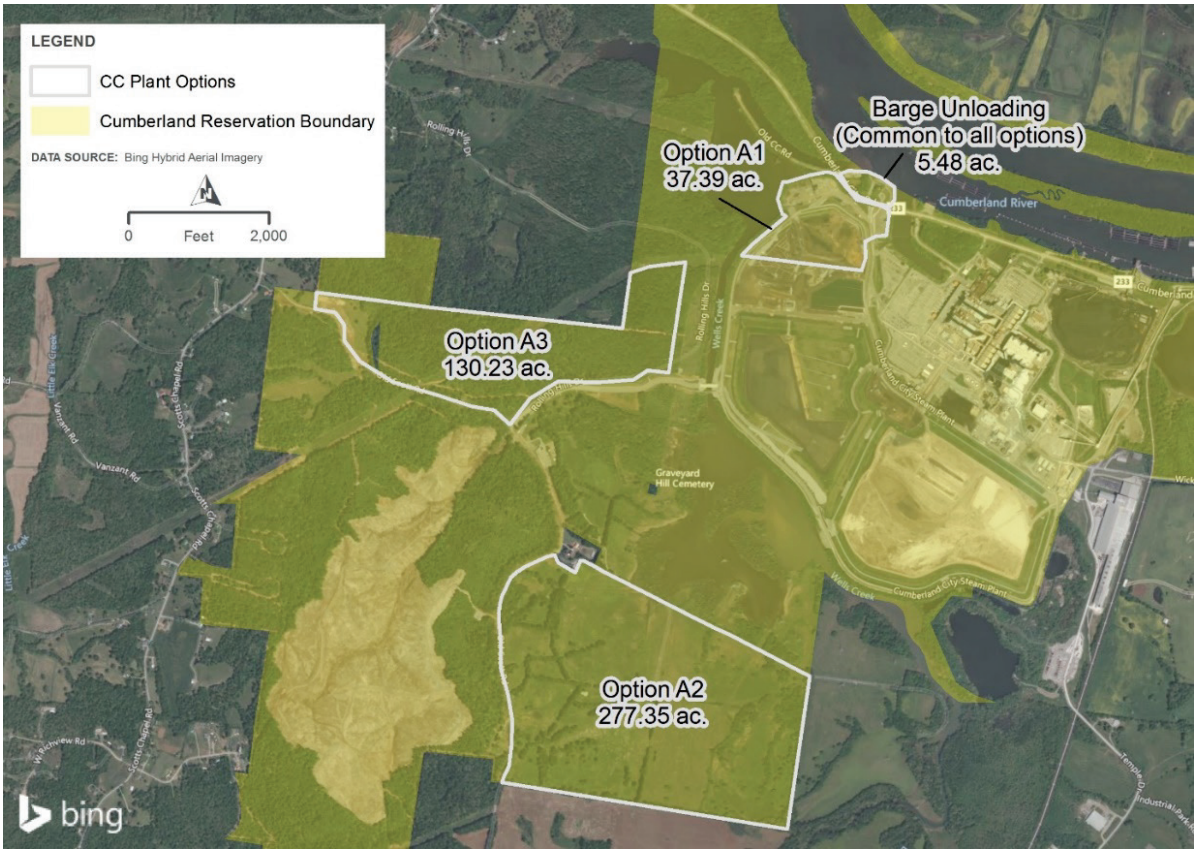

Figure 2.1-3. Alternative CC Plant Locations on CUF Reservation

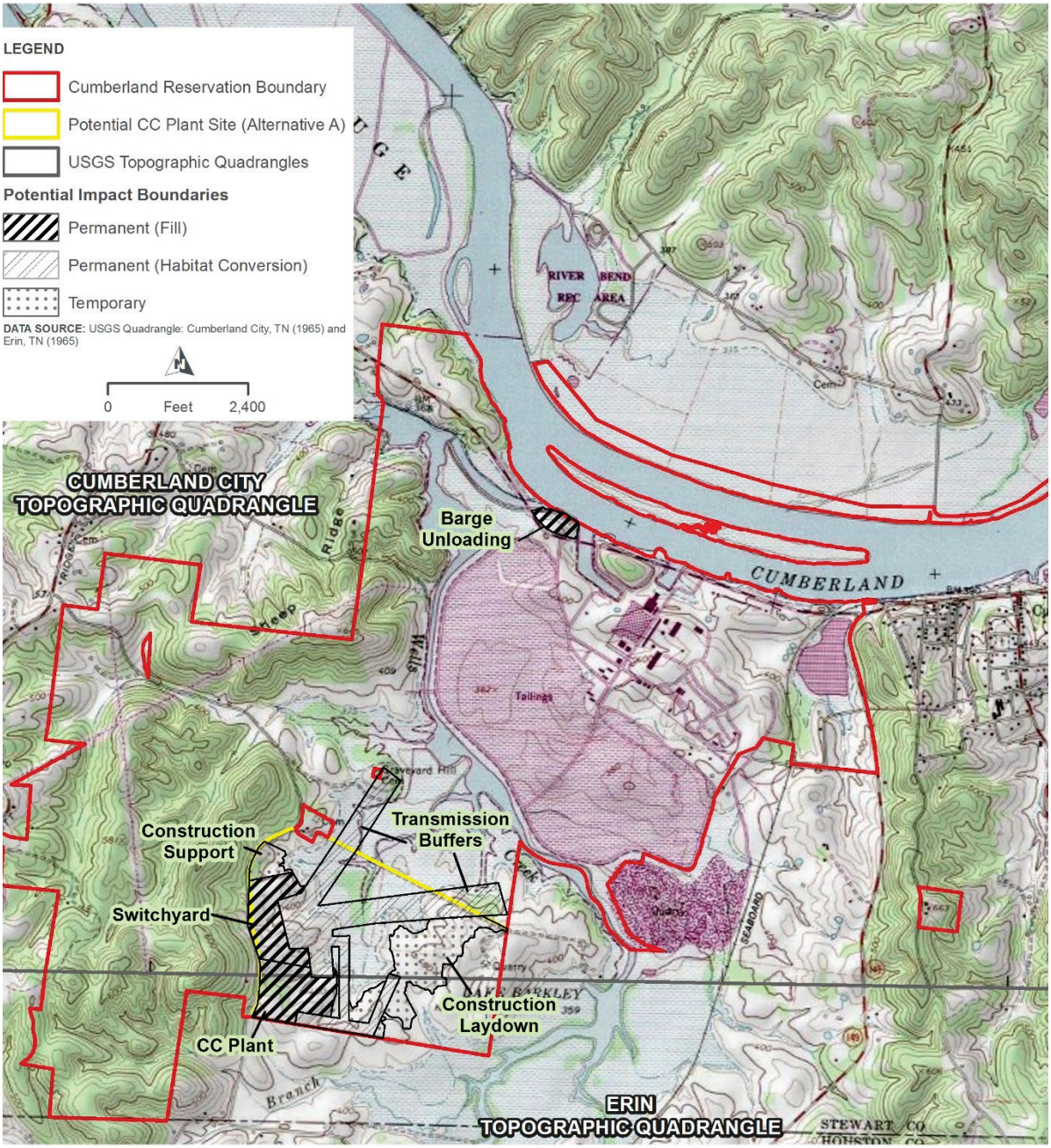

Figure 2.1-4. US Geological Survey Map of Cumberland Fossil Plant for Alternative A

2.1.3.2.2. Components of the CC Plant

Conceptual plans for the proposed CC Plant and associated transmission lines have been developed within Site A2 identified in Figure 2.1-3. Major components of the proposed CC plant are as follows:

- Two of the largest advanced class combustion turbines currently available on the market.
- HRSGs (one per combustion turbine) and air-cooled condensers.
- Auxiliary boilers to provide start-up steam.

- Selective catalytic reduction (SCR) system.
- Aqueous ammonia systems for the SCR.
- Gas system upgrades to existing infrastructure to enable connection of the plant to an approximately 32-mile-long natural gas pipeline lateral proposed to be constructed and operated by TGP.

Additional plant components include:

- Electric and diesel emergency firewater pumps.
- Two, one-million-gallon tanks for demineralized water storage.
- Pond(s) for holding and treating process and storm water flow; size of pond(s) to be determined after further engineering.
- Connection of the CC plant to the new 500-kV switchyard and subsequent tie-in to existing 500-kV TL corridor.
- Preliminary estimates indicate that approximately 245,040 dekatherms per day (Dth/d) of natural gas would be required for the CC plant. This demand would require gas pressure of up to 750 pounds per square inch, requiring TVA to construct and operate an on-site electric motor drive gas compression system to increase the pressure of the gas delivered to the site. The gas compression located on the CUF Reservation will not be part of the proposed TGP pipeline project.

2.1.3.2.2.1. Water Requirements

TVA proposes to use air-cooling instead of water-cooling, which would eliminate the need for water withdrawal from the Cumberland River or groundwater wells for the new CC. To prevent concentration of minerals in the steam cycle, the HRSG would require a demineralized water feed and boiler blowdown to remove accumulating minerals. CT compressor washing also requires demineralized water. Wash effluent would be treated and discharged at a CUF discharge outfall under an individual NPDES permit.

Potable water would be obtained from the existing public supply at the Cumberland Reservation (City of Erin Water Department), and demineralized water would be made and stored onsite in two, one-million-gallon tanks that would be constructed at the site of the CC plant. Some water treatment will be required to support the CC steam cycle and will be integrated into plant design.

2.1.3.2.2.2. Emission Monitoring and Controls

Operating the plant would require emission monitoring and controls in both CC and CT mode. Reduction of emissions of nitrogen oxides (NO_x) from CCs would be achieved through dry low- NO_x combustion systems. The CC plant would use an SCR system located within the HRSG for additional NO_x reduction. The SCR system would use 19.5 percent aqueous ammonia that would require installation of an independent storage/receiving system. Reduction of carbon monoxide (CO) would be achieved using a separate catalyst layer specifically for that pollutant. The new exhaust stacks would be equipped with continuous emissions monitoring systems.

2.1.3.2.2.3. Transmission and Electrical System Components

The TVA transmission system was designed and constructed to facilitate the transmission of power generated at CUF. By locating generation at the Cumberland site, as proposed

with Alternative A, the system will experience similar power flows and therefore will require less new transmission infrastructure than other alternatives to accommodate any new generation. If generation is not located at or near the Cumberland site, such as proposed with Alternatives B and C, the transmission system would require significant investment to be upgraded at the alternative generation sites and surrounding areas, and this effort would take additional time beyond the 2026 retirement date.

Under Alternative A, TVA would construct a new 500-kV switchyard at the CC plant site (Figure 2.1-4). The new switchyard will include a minimum of 8-double breaker bays, two 3-phase shunt reactor banks, and a new control house, including water and septic systems. TVA would install new station service to the new 500-kV control house. TVA will terminate four 500-kV generator ties in the new switchyard and will loop in two existing 500-kV TLs.

All construction, except 6 miles of fiber-optic ground wire installation, would be contained within the existing CUF Reservation boundary. All unit substation transformers would be oil filled; therefore, concrete foundations and an oil containment system would be included. The expected duration for the transmission work is 4 years.

The existing microwave communications will be moved from the current paths on the existing stacks at CUF and relocated to new paths to support the retirement of the CUF and construction of the new Cumberland CC plant. The existing microwave equipment on the CUF stacks will be retired in place. For the new path, a 150-foot monopole with associated microwave equipment would be installed in the existing CUF 161-kV switchyard. As needed, telecommunication equipment would be installed/replaced inside the existing CUF 161-kV switch house and a new fiber path would be run in existing conduit from the CUF 161-kV switch house to the CUF Powerhouse. Additionally, telecommunication equipment upgrades/installations would be required at TVA's existing CUF Cell Site; Lynn Grove, KY, Microwave Repeater Station; Model, TN, Microwave Repeater Station; and Vanleer, TN, Microwave Repeater Station. For these off-site locations, all work would take place within the existing switch house and/or existing communication structure in the yard. The expected duration for the transmission work is 4 years.

Installation of approximately 6 miles of fiber-optic ground wire (OPGW) would be performed with the aid of a helicopter along an existing transmission line (Figure 2.1-5). The helicopter would be utilized to place blocks at the top of each structure, which would be used to remove the existing overhead ground wire and pull in the new OPGW. Splice cases and pull points would be located approximately every 2 miles along the fiber route. TVA would need temporary access roads at each of these pull point locations to get to the structures. Additional details regarding this network upgrade, such as the exact locations of pull points or access routes, are still being developed. Supplemental environmental analysis would be conducted as details become available. Efforts would be made to minimize ground disturbance at these places, such as the use of light-duty trucks and/or ground matting.

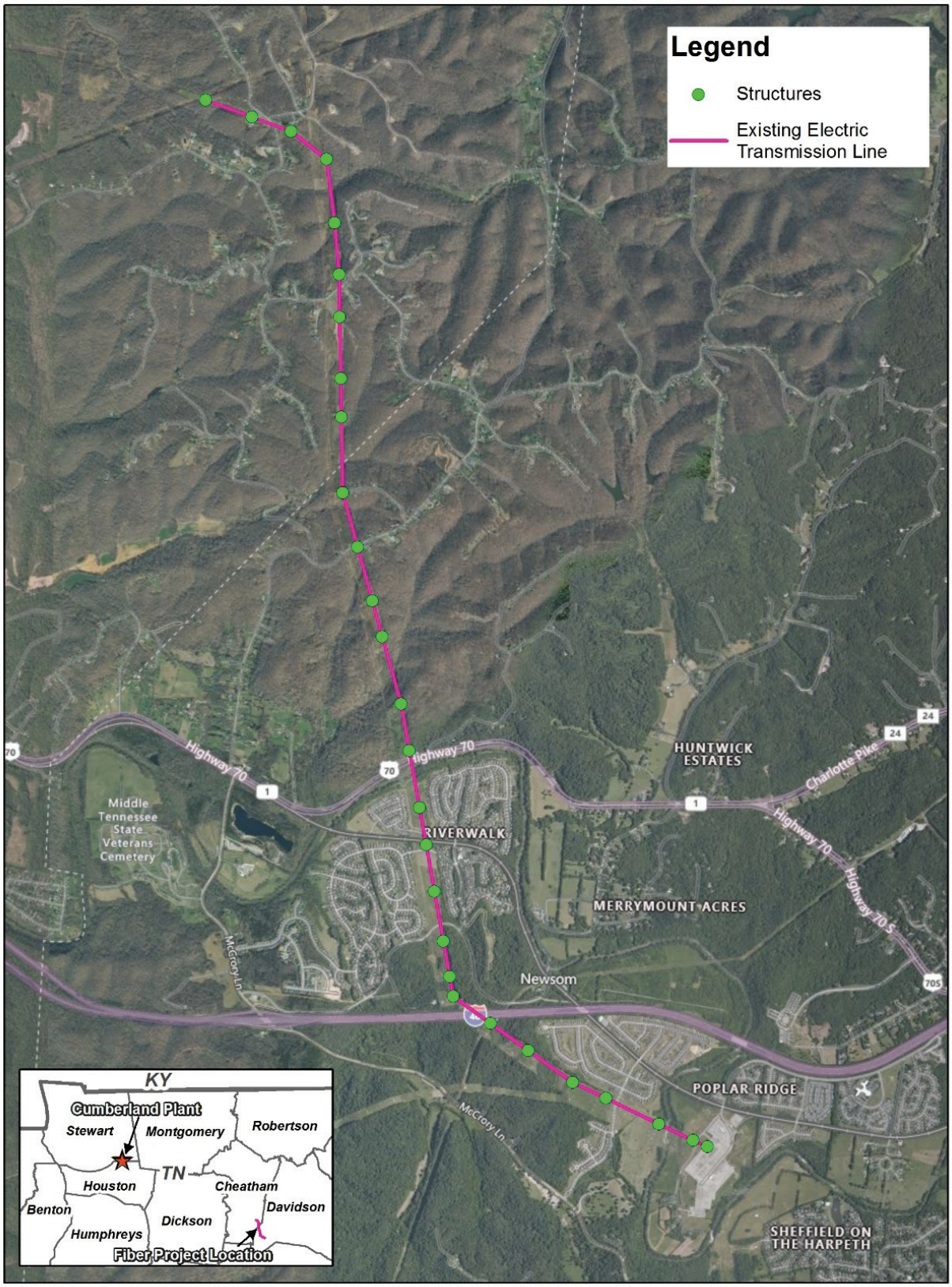

Figure 2.1-5. Proposed Fiber Optic Ground Wire

2.1.3.2.2.4. CC Plant Construction Activities

Construction activities associated with the CC plant other than the natural gas pipeline lateral would occur on the TVA Cumberland Reservation, Site A2. The plant would occupy approximately 30 acres, and an additional 10 to 20 acres on site would be used for equipment laydown and mobilization. Subsurface piles or other deep foundation system would be installed to support foundations for plant components, as required.

Larger project equipment could be delivered to the site by rail or barge and smaller items by truck. Improvements to the current barge unloading facilities (identified in Figure 2.1-3) would consist of grading and creation of dirt/rock ramping to the nose of the barge as well as potential concrete resurfacing and widening. Should in-water work be necessary for completion of the upgrades to the barge unloading facilities, TVA will pursue permit authorizations, as needed and required. Most delivered items would be placed in project laydown areas to await installation. Roads within the Cumberland Reservation would be maintained during the construction process.

Site preparation work for the proposed CC plant and associated equipment would begin in 2023. Actual plant construction would begin fall of 2023 and the plant would begin commercial operation as early as summer 2026. A maximum of 600 workers would be employed onsite during peak construction activity.

2.1.3.3. Natural Gas Pipeline

The CUF Reservation is located about 32 miles from an existing major interstate natural gas pipeline system which has adequate mainline capacity to serve a new CC plant. The operation of a new CC plant on the CUF Reservation would require construction of approximately 32 miles of a new single, 30-inch-diameter natural gas pipeline lateral and associated gas system infrastructure, together formally known as the Cumberland Pipeline Project, in Dickson, Houston, and Stewart counties in Tennessee. The approximate route of the proposed pipeline, to the extent that is practicable, feasible, and legally permitted, will be generally parallel and adjacent to an existing 500-kV TVA TL ROW, which is shown in Figure 2.1-6 and based on the proposed route information provided by TGP (TGP 2022a). TVA is treating the construction and operation of the pipeline as a related action and is evaluating the pipeline in detail in this EIS. TVA's initial analyses of the pipeline presented in the DEIS were based on desktop information for a 200-foot corridor that was available at the time of the DEIS. TVA, in this FEIS, has incorporated more detailed information from TGP's Application for a Certificate of Public Convenience and Necessity dated July 22, 2022 in FERC Docket No. CP22-493, including field surveys and other information in TGP's Resource Reports, which became available after TVA's DEIS was published. TGP used a typical 100-foot-wide construction ROW, not including additional temporary workspace (ATWS), for assessment of impacts regarding the installation of the pipeline (TGP 2022a).

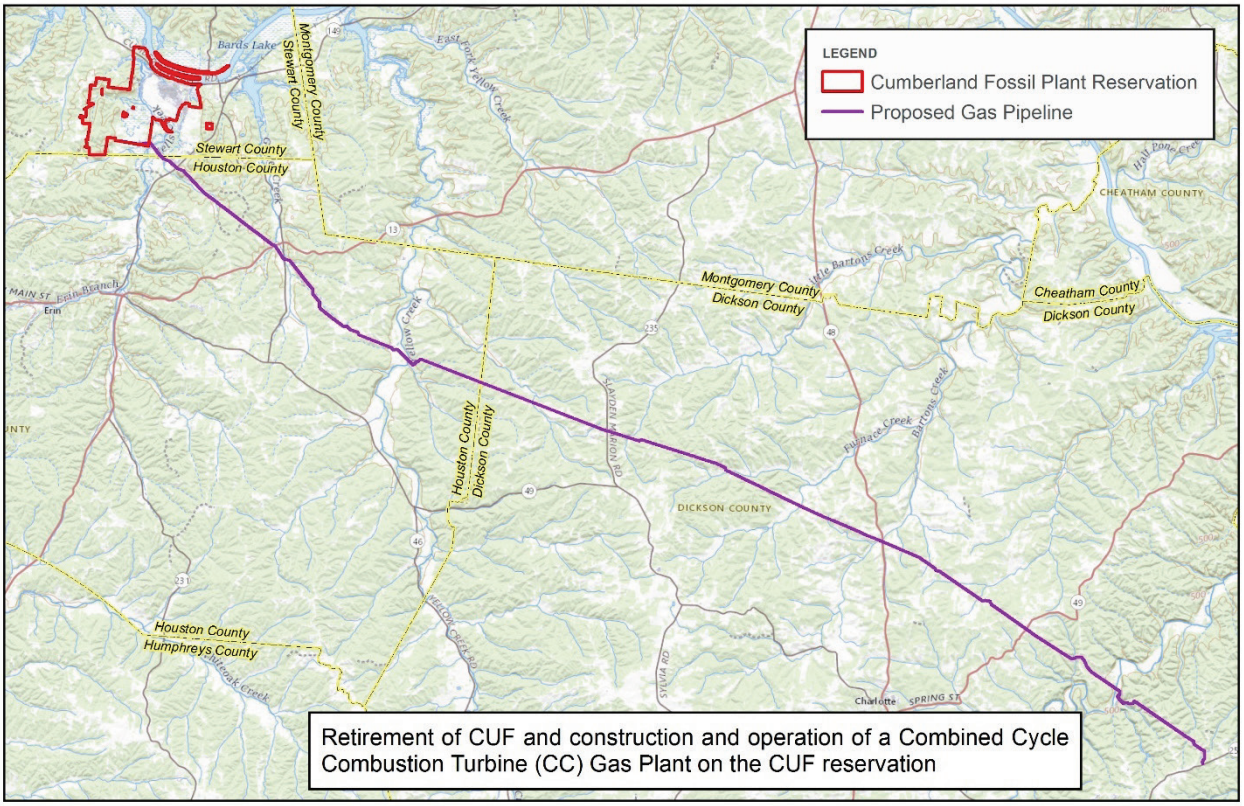

Figure 2.1-6. Alternative A – Proposed Natural Gas Pipeline Route

The pipeline requires approval by FERC through issuance of a certificate of public convenience and necessity under Section 7 of the Natural Gas Act. As described above, TGP submitted an application for a Certificate of Public Convenience to the FERC on July 22, 2022 (Docket CP22-493), which will be evaluated by FERC's engineering, environmental, legal, and economic staff in an EIS issued for public comment before a decision is made by the FERC. In addition to the approximately 32 miles of buried pipeline, the pipeline portion of the project includes the construction of the following aboveground facilities:

- a new meter station at the western end of the proposed pipeline and on 0.86 acres near the southwest corner of the CUF Reservation;
- new bi-directional back pressure regulation facilities near TGP's Lines 100-3 and 100-4 at the origin of the proposed new gas pipeline in Dickson County;
- construction of appurtenant and auxiliary installations including
    - a new pig launcher/receiver within the pressure regulation station
    - two new mainline valves at the connection with TGP Lines 100-3 and 100-4;
    - in-line inspection traps at each end of the proposed pipeline; and
    - one mainline valve at an intermediate location along the proposed pipeline.

Upon completion, the pipeline would provide approximately 245,040 Dth/d of firm natural gas transportation capacity to serve TVA's proposed CC plant (TGP 2022a).

TGP has initiated coordination with affected stakeholders and landowners and commenced civil, environmental, and cultural studies for the proposed pipeline route. Detailed analyses of the proposed pipeline and its impacts were provided by TGP as part of the FERC pre-filing process. TGP's Resource Reports were submitted with their FERC certificate application on July 22, 2022. TVA has drawn from these Resource Reports to evaluate the effects on the pipeline in this EIS. The FERC is preparing an EIS for the proposed pipeline portion of the project (FERC 2022). See Section 1.6 of this EIS for information on the FERC EIS schedule.

TGP anticipates a peak construction workforce of 300–400 personnel during construction of the pipeline. TGP would add the equivalent of one operational personnel to operate and maintain the completed pipeline facilities (TGP 2022a).

TGP has incorporated "industry standard construction, operation, and maintenance procedures in the design of the [pipeline] to minimize environmental impacts. TGP will design, construct, test, own, operate, and maintain the proposed facilities in accordance with applicable federal, state, and local laws, regulations, and other requirements. [Pipeline-related] environmental compliance, construction, and operation and maintenance procedures are described in the following sections [of TGP Resource Reports] and apply to all proposed facilities for the [pipeline]" (TGP 2022a). The Resource Reports are listed in the Literature Cited section of this EIS and are available on FERC's website under Docket CP22-493.

2.1.3.3.1. Environmental Compliance

As stated by TGP (2022a):

> The pipeline facilities would be designed, constructed, tested, owned, operated, and maintained to conform with applicable federal, state, and local requirements, including USDOT regulations at 49 CFR Part 192, 'Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards' and Section 380.15 of the Commission's regulations, 18 CFR § 380.15 (2022), 'Siting and Maintenance Requirements.' In addition, TGP would comply with the FERC *Upland Erosion Control, Revegetation, and Maintenance Plan* (FERC 2013a) and the FERC *Wetland and Waterbody Construction and Mitigation Procedures* with requested deviations from the FERC Procedures (FERC 2013b).

According to TGP (2022a):

> TGP would also follow its Spill Prevention Control and Countermeasure Plan (SPCC) and Unanticipated Discovery Plan (UDP) for cultural resources (discussed in Resource Report 4, *Cultural Resources*). These documents would be incorporated into TGP's Environmental Construction Management Plan (ECMP), which would apply to all proposed activities for the [pipeline]. The ECMP [would] incorporate applicable plans, permits, and clearances for the [pipeline], […] specify other BMP's that would be used to avoid and minimize adverse environmental impacts, […] and serve as the basis of the environmental training [provided by TGP].
>
> The construction contractor and TGP's construction inspection, environmental inspection, and oversight personnel [would] receive copies of the ECMP containing applicable environmental permits, plans, and procedures. TGP

[would] provide the construction contractor with site-specific environmental procedures and drawings to ensure compliance with the conditions of the certificate order, permits for the Project, BMPs and mitigation measures, and applicable notification requirements.

Throughout pipeline construction and restoration, TGP would implement mitigation measures contained in the ECMP, including the final versions of the following plans:

- FERC Plan;
- Draft FERC Procedures (with requested deviations);
- Draft SPCP;
- Draft Horizontal Directional Drilling (HDD) Contingency Plan;
- Draft Dust Control Plan;
- Draft Blasting Plan;
- Draft Unanticipated Discoveries Plan;
- Draft Noxious and Invasive Weed Control Plan;
- Draft Traffic Management Plan; and
- Draft Hydrostatic Test Plan.

TGP would incorporate recommendations and revisions from jurisdictional agencies, as applicable, into the plans that would be incorporated into the ECMP.

TGP [would] assign at least two Environmental Inspectors (EI) to oversee and document environmental compliance during construction at all proposed facilities for the [pipeline]. The EIS [would] inspect all disturbed areas of construction (e.g., construction workspace, contractor yards, temporary workspaces, and ATWS) that have not been permanently stabilized in accordance with the following schedule: (1) on a daily basis in areas of active construction; (2) on a weekly basis in areas with no construction or equipment operation; (3) within 24 hours of the end of a storm event that is 0.5 inch of rain or greater. All construction personnel for the [pipeline project would] be informed of the authority of the EIS and receive job-appropriate environmental training prior to beginning work on the [pipeline].

Activities for the [pipeline], including contractor mobilization of equipment, would not commence until after receipt of all necessary authorizations, including the certificate order and a Notice to Proceed with construction from [FERC].

2.1.3.3.2. Standard Pipeline Construction Methods

As detailed in TGP's Resource Report 1 (TGP 2022a):

> The general procedures for pipeline construction that would be followed for the Cumberland Pipeline are described in this section. TGP would use conventional industry techniques for buried pipeline construction and would follow the requirements set forth in the ECMP to ensure safe, stable, and reliable transmission facilities consistent with Commission and USDOT specifications. At a minimum, TGP would perform the following procedures:
>
> - Marking the corridor;
> - Erosion and sediment control;
> - Clearing and grading;
> - Trenching;
> - Stringing;
> - Pipe preparation (bending, welding, non-destructive testing, weld coating, and coating repair) and lowering in;
> - Backfilling and rough grading;
> - Hydrostatic testing and tie-ins; and
> - Clean-up and final restoration.

According to TGP's Resource Report 1 (TGP 2022a):

> The above-listed procedures would typically follow the sequence listed. Areas requiring special construction plans and techniques may include road or utility crossings, waterbodies and wetlands, unusual topographies such as unstable soils and trench conditions, residential or urban areas, and agricultural areas

See TGP Resource Report 1 for more details on the pipeline construction plants and techniques.

According to TGP's Resource Report 9 (TGP 2022i):

> TGP has modified the route of the proposed pipeline to minimize construction activities on residential land. Seven houses and eleven other buildings are located within 50 feet of the edge of the proposed construction workspaces. Construction near residential areas would be conducted in a manner to ensure that all construction activities minimize adverse impacts on adjacent residences and that clean-up is prompt and thorough. Measures to minimize impacts to residences and surrounding areas are discussed in Resource Report 8, *Land Use, Recreation, and Aesthetics* and Resource Report 9, *Air and Noise Quality*
>
> […] Trenchless construction methods may be used to construct pipelines in certain areas to minimize impacts to resources, such as waterbodies, roadways, significant cultural resources, or other sensitive areas. Using these techniques, the pipeline is installed below the resource using equipment

> staged at the edge of the sensitive area. For the pipeline, trenchless construction techniques considered are conventional bore and HDD.
>
> **Conventional Bore**
>
> Conventional boring consists of creating a shaft/tunnel for a pipe or conduit to be installed to minimize surface disturbance. This is accomplished by first excavating a bore pit and a receiving pit. The bore pit is excavated to a depth slightly deeper than the depth of the associated trench and is graded such that the bore [would] follow the proposed angle of the pipe. A boring machine is then lowered to the bottom of the bore pit to tunnel using a cutting head mounted on an auger. The auger rotates through a bore casing, both of which are pushed forward as the hole is cut. The pipeline is then installed through the bored hole and welded to the adjacent pipeline. The typical workspace configurations required for boring operations consist of staging areas (50 feet by 100 feet) for boring machine setup, cuttings/return settlement and storage pits, pipe storage, entrance and exit pit spoil storage, and construction equipment necessary to support the operation.
>
> Major factors limiting the success of a boring operation include the crossing distance, subsurface soil and geologic conditions, and existing topography. Boring operations typically occur over a crossing distance of 50 to 60 feet. The maximum length a bore could achieve in ideal soil conditions typically does not exceed 400 feet. Subsurface soil and geologic conditions must be conducive to establishing and maintaining a safe bore pit excavation, as well as provide the capabilities for the boring equipment to conduct a successful bore. Loose-packed sediment, free of rock material, is preferred when conducting boring operations. The topographic conditions at a site may also limit the use of this method, as preferred locations are generally […] level or moderately convex terrain, such that the depth of the bore pit does not present concerns relative to constructability or safety constraints.

As stated in TGP's Resource Report 1 (TGP 2022a):

> A total of eight public roads along the proposed pipeline are expected to be crossed via conventional bore, and one public road would be crossed via an HDD associated with the Yellow Creek crossing, as identified in Table 1.4-2 in [TGP's Resource Report 1].
>
> **Horizontal Directional Drill**
>
> HDD is a trenchless method of installing pipelines in areas where traditional open cut excavations are not practicable due to sensitive resource areas or logistical reasons. The greatest advantage of the HDD crossing technique is that open cut trenching and equipment disturbance for a large portion of area between the entry and exit points of the drill are not necessary and, as a result, impacts to resources in these areas can be minimized. However, a greater amount of equipment staging is required for HDD than for open cut crossing methods, and typical installation of an HDD segment generally occurs at durations two to three times slower than a conventional open cut crossing, often-times needing twenty-four-hour activity to complete the HDD and the

> resultant pipe installation. Geotechnical investigations at the HDD locations were completed in June 2022, and the resulting HDD Feasibility Study is [included in TGP's Resource Report 1]. Once the conditions are assessed by the HDD contractor, TGP may request Commission approval for 24-hour HDD operations at certain or all HDD sites to accommodate technical needs and construction schedule.

Additional information regarding the proposed HDDs is provided in TGP's Resource Report 2, Water Use and Quality (TGP 2022b); Resource Report 6, Geological Resources (TGP 2022f)*;* and Resource Report 9, Air and Noise Quality (TGP 2022i). Three HDDs are proposed, at Jones Creek, Yellow Creek and an unnamed tributary, and Wells Creek.

TGP Resource Report 1 (TGP 2022a) states:

> Generally, a minimum workspace footprint of 200 ft wide by 200 ft long is required at the entry and exit points to support the drilling operation, which includes a typical workspace corridor of 100 ft and ATWS. The amount of workspace required can vary significantly from site to site based on site-specific conditions, how the drilling equipment is setup, and the size of equipment used. The entry side equipment and operations typically [would] include the drilling rig and entry hole/slurry pit, control cab, drill string pipe storage, site office, tool storage trailers, power generators, bentonite storage, bentonite slurry mixing equipment, slurry pump, cuttings separation equipment, cuttings return/settlement pit, water trucks and water storage, and the heavy construction equipment necessary to support the operation.
>
> […] Exit side equipment and operations typically [would] include the exit point and slurry containment pit, cuttings return/settlement pit, cuttings separation and slurry reclamation equipment, drilling string pipe storage, and the heavy construction equipment necessary to support the operation. In addition to the drilling operations to be conducted within this workspace footprint, ATWS may be required along the working side ROW beyond the construction ROW to provide a straight corridor for stringing/handling pipe. This ATWS would be used to prefabricate the pipeline into one continuous section in preparation for pulling it back through the drilled hole; this process is typically referred to as 'pull-back.' Once the pull-back section of pipe is welded and pre-tested, the pipeline [would] be placed on pipe rollers so that it may be conveyed into the drilled hole during the pull-back operation.
>
> The HDD process involves use of a drilling fluid (also referred to as drilling mud) made up primarily of water and bentonite, with pH values between 8 and 10. Bentonite is a naturally occurring, non-toxic, inert substance that meets National Sanitation Foundation/American National Standards Institute (NSF/ANSI) Standard 60 and 61 Drinking Water Additives Standards and is frequently used for drilling potable water wells.
>
> The primary purposes of drilling fluids are to remove the cuttings from the borehole, stabilize the borehole, and act as a coolant and lubricant during the drilling process. The water and clay drilling fluid consists of 1 to 5 percent active clays and from 0 to 40 percent inert solids with the rest being water. The primary active clay component is bentonite.

> TGP [would] engage a specialty HDD contractor to complete the HDDs. The selected HDD contractor would use its experience and expertise to determine what drilling fluid additives to use during each stage of each HDD. […] Drilling fluids would vary for the conditions encountered at each site and along the HDD path. Drilling fluid materials under consideration, in addition to bentonite, include a wetting agent, biopolymer gel strength enhancer, filtration control additive, polymer emulsion, clay breaker /ball buster / surfactants, suspension booster, sealing / plugging agent, pH control agents, wetting agent, and swell inhibitor.

TGP Resource Report 1 (TGP 2022a) states:

> HDD drilling fluids [would] be disposed of in accordance with applicable federal, state, and local requirements and guidelines. The HDD contactor [would] secure drilling fluid disposal locations and make those locations part of the HDD Contingency Plan. TGP [would] review and approve each of the disposal areas. The HDD contractor [would] be required to provide TGP with the necessary documents to prove disposal areas that are approved prior to any disposal. If necessary, HDD fluids [would] be tested to meet permit disposal requirements. If land farming of drilling fluids is determined to be an approved disposal method, TGP [would] ensure all the necessary surveys/clearances and landowner approvals have been obtained prior to disposal
>
> There are risks associated with HDD, including inadvertent returns during drilling operations resulting in the loss of drilling fluid through hydraulically induced fractures, drilled hole collapse during drilling or reaming, and inaccessibility of the pipe for visual inspection and repairs post-construction. TGP's Draft HDD Contingency Plan in Resource Report 1 establishes procedures for addressing potential impacts associated with a release of drilling fluid through hydraulically induced fractures during the HDD process. The HDD Contingency Plan would be finalized after the HDD contractor has been selected, and TGP would provide updates on the updated plan.

Due to the bedrock substrates found in streambeds in the pipeline corridor, blasting likely would be required at approximately 40 (27 percent) of the pipeline waterbody crossings. TGP would strictly adhere to all federal, state, and local regulations applicable to controlled blast, and blast vibration limits with regard to structures and underground utilities while performing blasting activities. Special care would be taken to monitor and assess blasting within 250 feet of dwellings and 150 feet of private or public water supply wells. Additional information regarding blasting is addressed in Resource Report 6, *Geological Resources* and TGP's Draft Blasting Plan (TGP 2022f).

2.1.3.4. Summary of Alternative A

Alternative A is consistent with the need set forth in the 2019 IRP to establish new capacity in the TVA region, and increase reliability and flexibility, as well as meeting near-term TVA energy production goals. Financial and system analysis indicates that replacement with a CC plant is the best overall solution to provide low-cost, reliable, and cleaner energy to the TVA power system. In addition, the proposed CC plant at CUF provides the flexibility needed to support the integration of 10,000 MW of solar into the system by 2035 and enables the CUF coal-fired units to be retired on an accelerated schedule. Further, the

proposed CC plant could be built and made operational by 2026, as required to meet the project purpose and need and reduce economic, reliability and environmental risks.

In contrast, although Alternatives B and C would provide the necessary replacement power, these alternatives would require substantial transmission upgrades and lengthy timeframes for the transmission work such that they would not meet the need to provide replacement generation by the time the first CUF unit is retired in 2026. Moreover, Alternative C would not provide the firm, dispatchable generation needed to meet year-round generation needs and therefore would raise challenges with grid reliability, nor would it meet TVA's least-cost mandate.

2.1.4. Alternative B – Retirement and demolition of CUF and construction and operation of Simple Cycle CT Gas Plants at alternate locations

2.1.4.1. Retire and Demolish CUF

The actions to retire and demolish CUF are the same as those described for Alternative A in Section 2.1.3.1.

2.1.4.2. Site Evaluation for New CTs

Under Alternative B, the construction of two CT plants at alternative locations would replace capacity of the first CUF unit, which would be retired in 2026 after construction is completed on the CT plants. Combustion turbines (2.1-7) are designed to meet peaks in power demand very quickly (TVA 2021d). These CTs draw in air at the front of the unit, compress it, mix it with fuel, and ignite it. The combustion occurs immediately, allowing gases to then expand through turbine blades connected to a generator to produce electricity. CT plants are typically operated with natural gas, but in some cases utilize fuel oil as an emergency back-up source. The proposed CTs under Alternative B do not include the use of fuel oil.

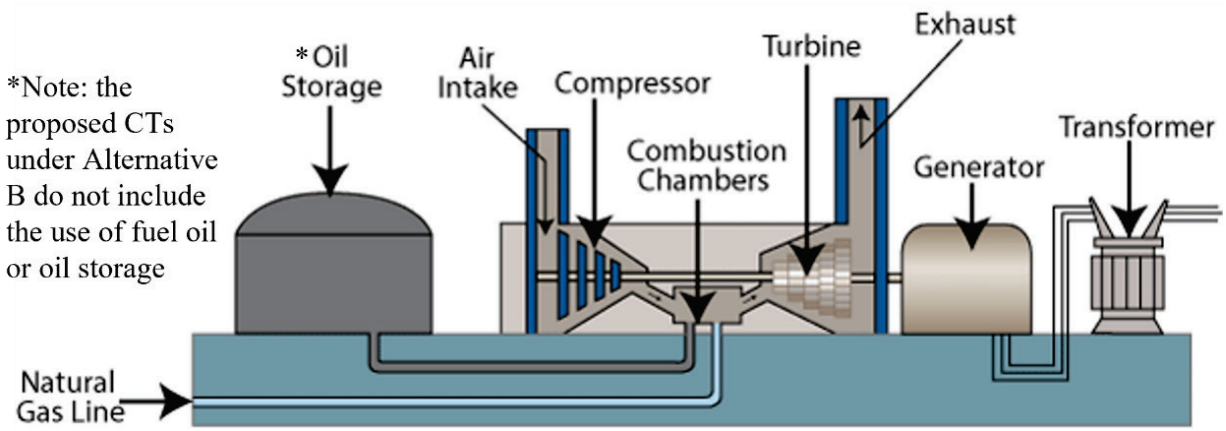

Figure 2.1-7. Illustration of a Typical Combustion Turbine Plant

Source: TVA 2021d

TVA identified candidate sites for the location of two new CT facilities based on a desktop review of TVA power plant reservations with existing transmission access and nearby natural gas supply of sufficient additional capacity or that would require limited upgrades. Initial site screening resulted in five potential locations for new CT facilities: Gleason, Johnsonville (JCT), Kemper, Lagoon Creek, and Southaven. Natural gas-fired power plants are currently operating on all these sites. These sites were evaluated using the following criteria summarized in Table 2.1-3.

Table 2.1-3. Criteria Evaluated to Determine the Location of New CT Facilities

Transmission	Site Considerations	Operational Considerations
• System upgrades needed • Locational value	• TVA owned vs non-TVA owned sites • Site availability (available for purchase) • Land cost	• Supply chain considerations • Staffing
Fuel Supply	**Environmental Considerations**	**Financial and Planning Considerations**
• Cost • Availability • Reliability • Operational considerations	• Environmental regulations • Sensitive environmental/cultural resources present	• TVA's Long Range Financial Plan • TVA's Integrated Resource Plan

After further evaluation from a transmission and fuel supply perspective, Gleason and JCT were determined to be the most practicable CT sites for Alternative B. Under Alternative B, TVA would construct three frame CTs at Gleason and four at JCT for a combined total of approximately 1,530 MW. These two locations offered several advantages to alternative locations, including:

- The construction footprints for the new CTs could be located on TVA property as opposed to purchasing or utilizing greenfield property, resulting in lesser environmental effects than the alternative locations.
- These reservations currently include transmission interconnection to the TVA system, which can reduce costs and time to interconnect the new facilities.
- All potential sites have existing pipeline infrastructure to access gas supply, which can either be used or upgraded to supply the additional proposed generation.

2.1.4.3. Locations and Descriptions

2.1.4.3.1. Johnsonville Reservation

The JCT Reservation is located near New Johnsonville in Humphreys County, Tennessee (Figure 2.1-8). The reservation is approximately 720 acres and located on the east bank of Kentucky Reservoir on the Tennessee River. The reservation once hosted 10 coal-fired units, which have all been retired and demolished, and currently hosts 20 active CT units, one of which supplies co-generation steam to an adjacent industrial site. Current plans are for CT units 1-16 to be retired at the end of calendar year 2024. To support the IRP recommendation to enhance system flexibility, TVA plans, as part of a separate action, to construct and operate 10 natural gas-fired aeroderivative CTs generating approximately 550 MW on the JCT site. This action was evaluated in a recently completed EA (TVA 2022f). These new CT units will be in commercial operation by the end of 2024.

In this EIS, under Alternative B, TVA would construct and operate an additional four natural gas-fired CTs on the JCT site. Potential areas suitable for their construction are identified in Figure 2.1-9.

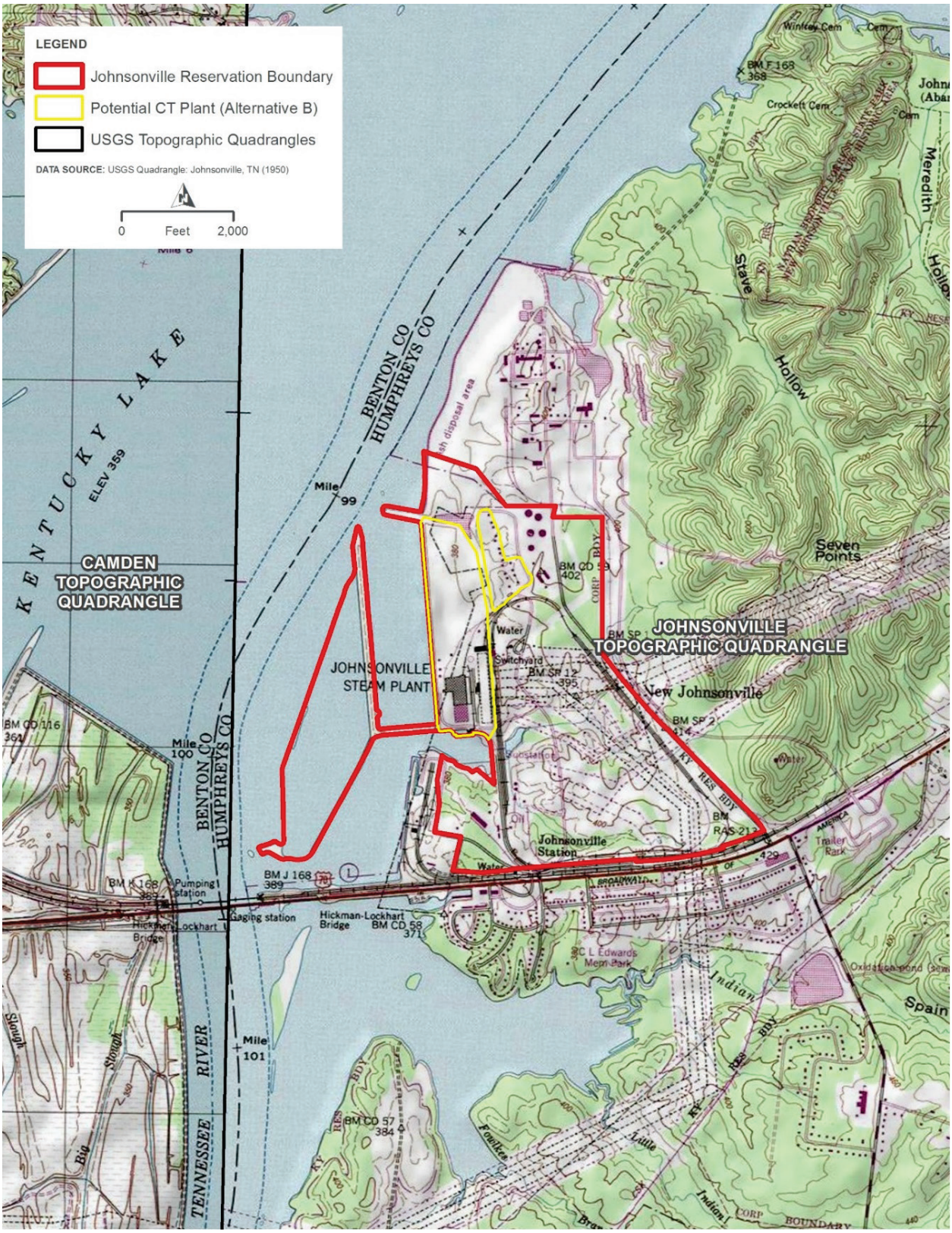

Figure 2.1-8. US Geological Survey Map of Johnsonville Reservation for Alternative B

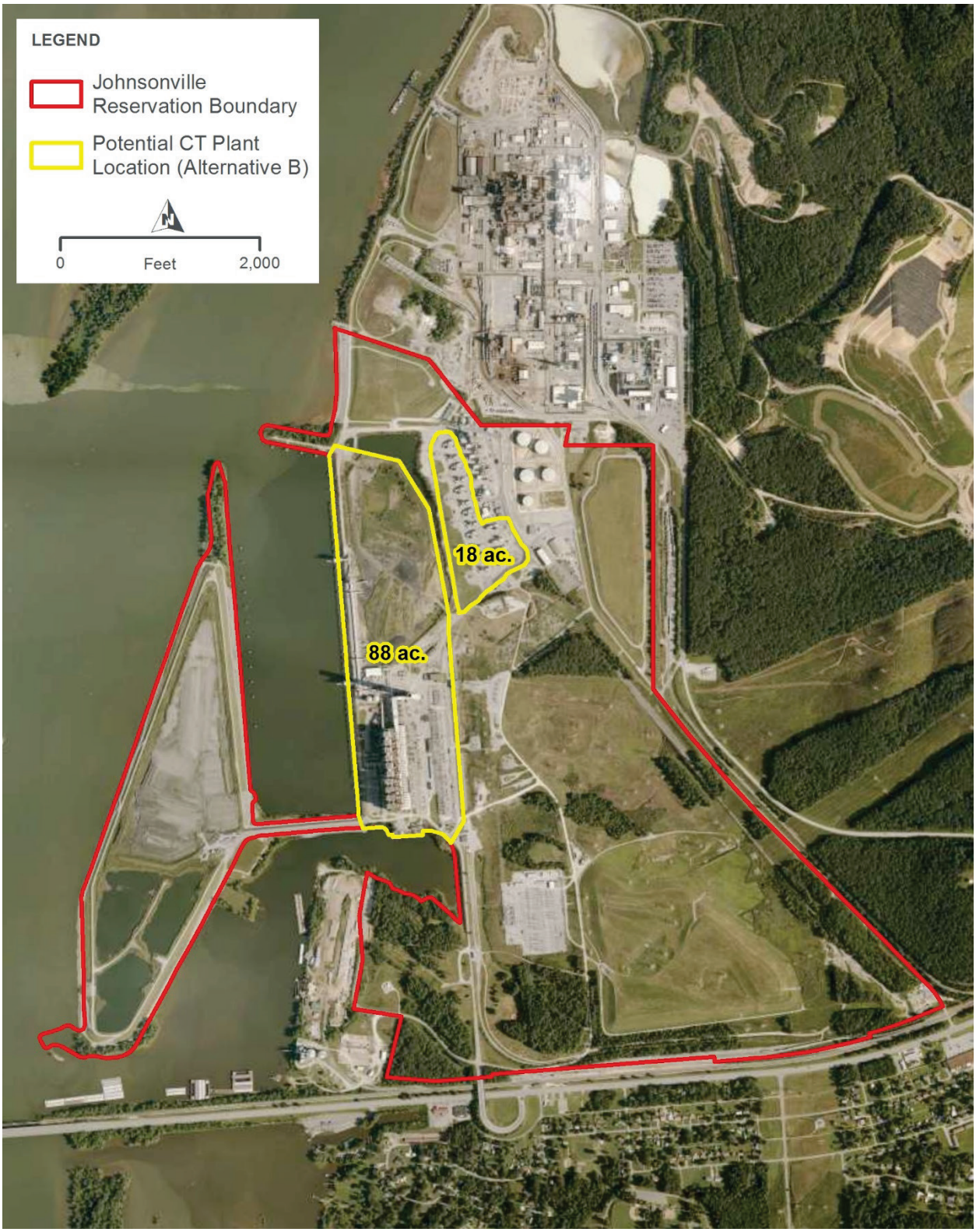

Figure 2.1-9. Potential Locations of CT Units on Johnsonville Reservation

2.1.4.3.2. Gleason Reservation

The 97-acre Gleason Reservation is located near Dresden in Weakley County, Tennessee (Figure 2.1-10). The reservation currently hosts three active CT units with a combined generation capacity of 500 MW (TVA 2022b). Under Alternative B, three additional CTs would be constructed within the 62 acres of undeveloped land adjacent to the existing units. The proposed location for the new CTs is illustrated in Figure 2.1-11.

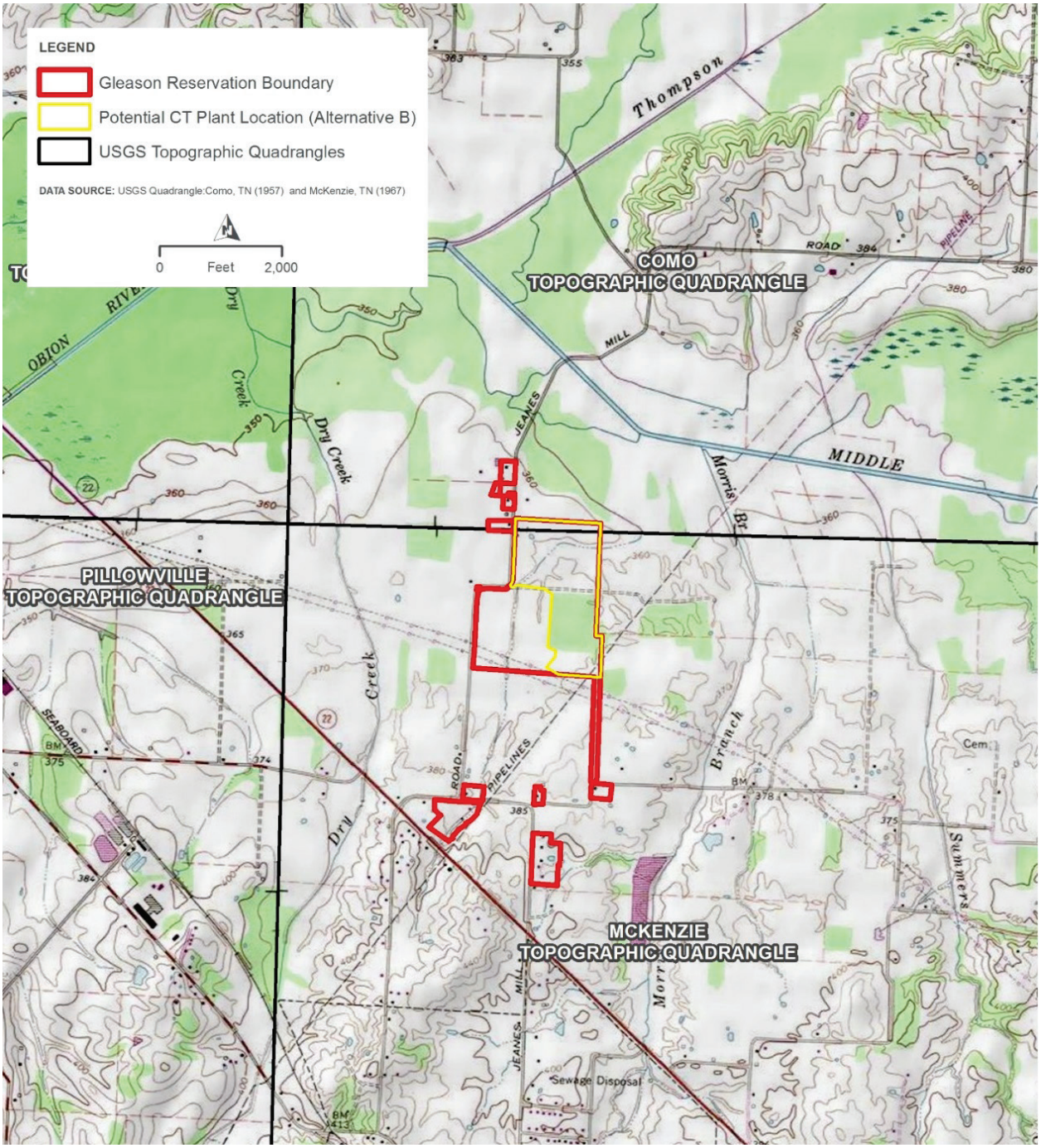

Figure 2.1-10. US Geological Survey Map of Gleason Reservation for Alternative B

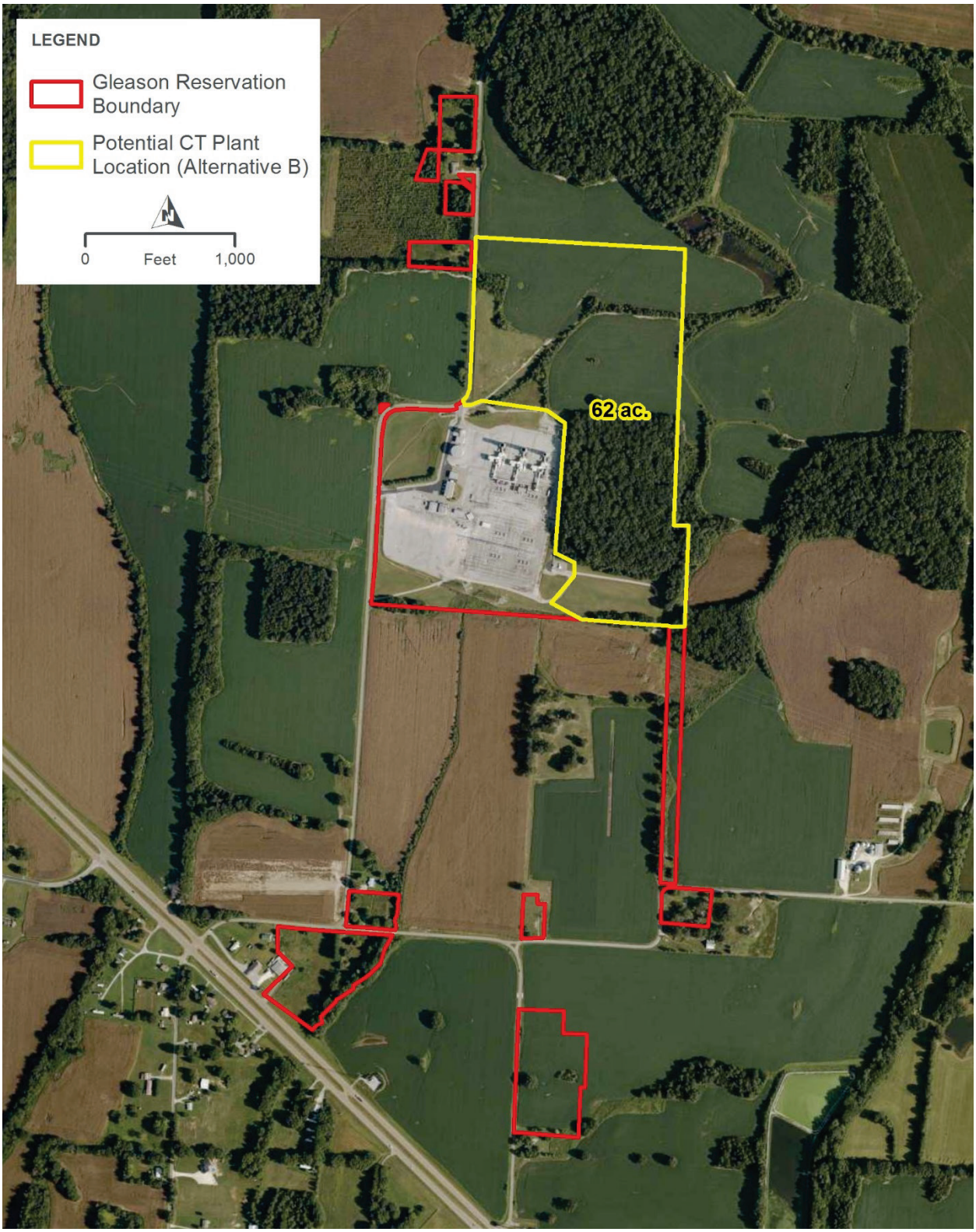

Figure 2.1-11. Potential Location of CT Units on Gleason Reservation

2.1.4.4. Components of the CT Facilities

The components, processes, and other features of the proposed CT facilities are described in Table 2.1-4.

Table 2.1-4. Components, processes, and other features of the proposed CT Facilities for Alternative B

System components	Johnsonville Reservation	Gleason Reservation
Major Equipment Systems	Gas-fired frame CT generators with inlet evaporative cooling and natural gas-fired dew-point gas heaters. Subsurface piles would be installed to support foundations for plant components, as required.	
Plant Equipment and Systems	Natural gas metering and handling systems; instrumentation and control systems; transformers; and administration and warehouse/maintenance buildings.	
CT Plant Area	Less than 10 acres each for both sites.	
Area Available for Vehicle and Equipment Parking, Materials Storage, Laydown, and Construction Administration During Construction	33 acres from previous projects, inclusive of temporary use area that could be designated for light uses, such as trailer placement or light vehicle parking during construction. The laydown and temporary use areas are all located on previously disturbed areas and, when construction is complete, they would be allowed to revert to their original use.	60 acres from previous projects, inclusive of temporary use area that could be designated for light uses, such as trailer placement or light vehicle parking during construction.
Project Material and Equipment Delivery	By rail, utilizing the existing rail spur, and trucks.	Delivered by rail to McKenzie, TN and then delivered to the project site by truck and placed in designated project laydown areas until used. The route is approximately 13 miles from the rail station to the Gleason Reservation, and it is expected that approximately 10 truck trips would be needed for the delivery of materials from the rail station to Gleason.
Equipment Used During the Construction Phase	Trucks, truck-mounted augers and drills, excavators, as well as tracked cranes and bulldozers. Low ground-pressure-type equipment would be used in specified locations (such as areas with soft ground) to reduce the potential for environmental effects per TVA BMPs.	
Workers Needed*	A maximum of 180 workers would be employed at each site at the peak of the two-year construction period, and four to six additional staff would be utilized for operations after construction for both Gleason and JCT.	

System components	Johnsonville Reservation	Gleason Reservation
Water Requirements	Up to about 130 gallons per minute (GPM) for inlet air evaporative cooling in summer ambient temperatures. Potable water for domestic use and safety showers would be obtained from the existing public supply.	Up to about 100 GPM of potable water for inlet air evaporative cooling in summer ambient temperatures. Potable water for domestic use and safety showers would be obtained from the existing public supply.
Emission Monitoring and Controls	Reduction of NO_x emissions from the CTs would be achieved through dry low- NO_x combustion systems. Exhaust stacks would be equipped with continuous emissions monitoring systems. Emissions from the units would adhere to the requirements of TDEC and federal regulations.	
Natural Gas	New gas compression would likely be needed onsite. 220 million standard cubic feet per day (MCF/day) of natural gas would be needed to fuel four frame CT units at each plant, running at maximum capacity. Four gas heaters would burn 320,000 standard cubic feet of natural gas per day if running at the same maximum capacity, requiring piping to connect the CTs to the existing natural gas pipeline lateral and metering station. Expansion of the existing metering station would be constructed within plant boundaries. Exact location has not yet been determined.	New gas compression may be needed onsite. 165 MCF/day of natural gas would be needed to fuel three frame CT units at each plant, running at maximum capacity. Three gas heaters would burn 240,000 standard cubic feet of natural gas per day if running at the same maximum capacity, requiring piping to connect the CTs to the existing natural gas pipeline lateral and metering station. Expansion of the existing metering station would be constructed within plant boundaries. Exact location has not yet been determined.
Transmission and Electrical System Components	Add four new double breaker bays to 500-kV yard for the four new CT units and four new breakers in the existing bays with TLs that only have one breaker. Construct new switchyards or expand current switchyards as needed to allow for expansion. Provide redundant metering and install digital fault recorders and relays for all new transmission and generation work.	Convert 500-kV yard to a double breaker configuration, add three new double breaker bays for the three new CT units, and add two breakers each in two existing double breaker bays. Construct new switchyards or expand current switchyards as needed to allow for expansion. Provide redundant metering and install digital fault recorders and relays for all new transmission and generation work.
Transmission Upgrades	Construct a new approximately 40-mile 500-kV TL from the Weakley 500-kV station to a new switching station on the Marshall-Cumberland 500-kV TL; install a new 500kV breaker to convert the existing 3-position ring bus at Weakley into a 4-position ring bus; install redundant metering and relays; construct the new 500 kV station on the Marshall-Cumberland 500 kV TL with three double breaker bays; install a new	

System components	Johnsonville Reservation	Gleason Reservation
	switch house potentially including water and septic systems; install new station service to the new 500 kV switch house; and provide redundant metering and install digital fault recorders and relays for all new transmission and generation work. All unit substation transformers would be oil filled; therefore, concrete foundations and an oil containment system would be included.	
Offsite Upgrades to Existing TLs and Stations	Existing 161-kV TLs may need to be reconductored or rebuilt. Also, reactive support in the form of installing tertiary reactors on area transformers and/or a static var compensator site may be required at 500-kV and/or 161-kV substations.	

*This does not include the construction workforce needed for offsite TL upgrades, if required, as this work is not centralized in one location for any significant period of time. Once constructed, eight to twelve employees could be needed to operate the CTs at both JCT and Gleason in addition to current staff

2.1.4.4.1. Transmission Lines

As noted above, if generation is not located at or near the Cumberland site, as would be the case with Alternative B, the transmission system would require significant investment to be upgraded at the alternative generation site and surrounding areas. As noted in Table 2.1-4, Alternative B would involve construction of approximately 40-miles of new 500 kV TL from the existing Weakley 500-kV substation south of Martin, Tennessee to a new station on the Marshall-Cumberland 500-kV TL near Buchanan, Tennessee. Additional 161-kV TLs may need to be reconductored or upgraded. The new 500-kV TL would be constructed on a ROW approximately 175 feet wide and occupying about 850 acres.

Although the exact route of TL that would be required for Alternative B has not been determined, upgrades that are typically performed to increase the electrical capacity of the existing TLs include the following:

- *Moving Features that Interfere with Clearance*. As more electricity is transmitted through the TL, the conductor (the cable that carries the current) temperature rises and the TL may sag. Features, such as sheds or storage buildings, located within the ROW may interfere with the ability to operate the TL safely and would be moved.
- *Replacement or Modification of Existing TL Structures or Installation of Intermediate TL Structures.* Typical TL structure replacement, extensions, or installation of intermediate TL structures is performed with standard TL equipment, such as bulldozers, bucket trucks, boom trucks, and forklifts. The result of this work is that the existing conductor is raised to provide the proper ground clearance, resulting in taller structures. Disturbance is usually limited to an approximately 100-foot radius around the work structure.
- *Conductor Modification.* Conductor modifications include conductor slides, cuts, or floating dead-ends to increase ground clearance. A cut involves removing a small amount of conductor and splicing the ends back together. A slide involves relocating the conductor clamp on the adjacent structure a certain distance toward the area of concern (i.e., “sliding” the clamp). No conductor is removed. A floating dead-end shortens the suspension insulator string of a structure to gain elevation at the attachment point of the conductor, increasing a span’s clearance. These

improvements require the use of a standard-size bucket truck; disturbance is minimal and confined to the immediate area of the clearance issue. The end result of these modifications is to raise the conductor to increase ground clearance.

- *Conductor Replacement*: If the existing conductor size cannot support the TL's electrical load, the conductor must be replaced. Bucket trucks or other light-duty equipment are utilized for access and stringing equipment. Reels of conductor would be delivered to various staging areas along the ROW, and temporary clearance structures would be installed at road crossings to reduce interference with traffic. The new conductor would be connected to the old conductor and pulled down the TL through pulleys suspended from the insulators. A bulldozer and specialized tensioning equipment would be used to pull conductors to the proper tension. Crews would then clamp the wires to the insulators and remove the pulleys. Wire pulls vary in length but are limited to a maximum of five-mile pulls. Pull point locations depend on the type of structures supporting the conductor as well as the length of conductor being installed and are typically located along the most accessible path on the ROW (adjacent to road crossings or existing access roads). The area of disturbance at each pull point typically ranges from 200 to 300 feet along the ROW.
- *Adding Surcharge.* Adding rock or dirt (surcharge) to structure footing is sometimes required when height and/or loading modifications are made to a structure. These changes can create uplift on the existing tower footings or grillage, therefore requiring a rock base settlement to be placed around the existing footings. The additional burden prevents the tower from rising under certain conditions (i.e., weather conditions or conductor loading). Typical installation of surcharge is performed with tracked equipment with minimal ground disturbance. The rock or dirt is piled around the footings as required, and the depth varies depending on the uplift on the affected structures.
- *Modification of Local Power Company Distribution Lines*. Local utilities' distribution lines can intersect TVA TLs. If the distribution line crossing does not have adequate clearance, TVA requests that the local utility lower or re-route the crossing.
- *Fiber Optic Ground Wire Installation.* New fiber optic line can be installed with the help of a helicopter, which allows technicians to clip in the new wire at designated pull points along the TL corridor where cable reels of optic fiber ground wire are set up. Pull point locations are typically located along the most accessible path on the ROW (adjacent to road crossings or existing access roads). Modifications to the existing TL are typically required along the length of the TL. Existing access roads would be used for the pull point locations.

Standard practices that are typically performed to install new TLs include the following:

- *Clearing and Grubbing.* The clearing contractor will clear minor wooded portions of the ROW, bush hog other areas as necessary, and install BMPs, which helps reduce erosion and sedimentation during soil disturbance and line installation.
- *Establish Site Access*. Access roads suitable for construction equipment will be constructed at points strategic to structure locations. When feasible, existing roads will be used and improved with minor grading and/or addition of gravel. Construction exits will be installed if needed where access points intersect paved roads.
- *Line Construction*. Construction crews will spot the material at the site, install the new pole structures, string and sag conductor, and clip in conductor.

- *Site Restoration*. After line installation, the clearing contractor will perform final restoration of the site and remove all temporary BMPs. Areas disturbed by clearing but not expected to be disturbed further will be restored during initial clearing.

Development of new permanent access roads to support upgrades to the existing TLs or installation of new TLs may be required. Depending on access needs, existing access roads may require modifications, such as brush clearing or tree trimming, to allow for passage of equipment and bucket trucks. Tree removal is not anticipated and if required would be a negligible amount. Modifications would generally be limited to the existing 20-foot-wide access road area, and, if needed, tree trimming to allow a vertical clearance of up to 12 feet. Minimal ground disturbance is expected in these areas, but if the ground is disturbed, the access road area would be revegetated using native, low-growing plant species after required TL upgrade or new TL installation work is completed. Areas, such as pasture, agricultural fields, or lawns, would be returned to their former condition.

If detailed studies are performed in the future that evaluate needed improvements to the regional transmission system to maintain system stability and integrity and additional transmission needs are identified, site-specific reviews would be conducted to further investigate potential effects to the environment. If warranted, tiered NEPA documentation would be prepared.

The expected duration for the transmission work for Alternative B is 8 to 10 years.

2.1.4.5. Alternative B Summary

Alternative B would provide the necessary replacement power through the construction and operation of a 4-unit CT plant on a heavily disturbed former coal plant site on the Johnsonville reservation and a 3-unit CT plant on a relatively undisturbed portion of the Gleason Reservation. Both sites have an adequate existing natural gas supply and could be developed with minimal off-site impacts. However, this alternative also requires the construction of a 40-mile, 500-kV transmission line and 500-kV substation in northwest Tennessee.

While construction of the two CT plants could be completed by 2026, the 8–10-year period required for planning, permitting, and constructing the 500-kV transmission facilities precludes them from being operational by 2026. Accordingly, Alternative B could not provide replacement power for the first retiring CUF unit by 2026 as needed.

2.1.5. Alternative C - Retirement of CUF, demolition of the units and construction and operation of Solar and Storage Facilities, at alternate locations, primarily in Middle Tennessee

2.1.5.1. Retire and Demolish CUF

The actions to retire and demolish CUF are the same as those described for Alternative A in Section 2.1.3.1.

2.1.5.2. Solar Plus Storage Approach

Under Alternative C, solar and battery storage facilities would be completed primarily at alternative locations to replace the generation of one of the units at CUF, which would be retired in 2026. TVA would replace the power generated and dependable capacity provided by one of the CUF units through the construction and operation of utility-scale solar facilities and battery storage facilities. To sustain low costs and high reliability, TVA anticipates a large portion of these new facilities would need to be located in Middle Tennessee, where

they can help support transmission grid stability following the retirement of the CUF unit. Battery storage, also known as battery energy storage systems (BESS), are devices that store energy from the grid and renewable sources, typically during periods of surplus power or low demand, and then release that energy when customers need power. Mechanical or chemical battery options could be utilized for storage. The following section describes the approach TVA would use under Alternative C to combine solar and storage to replace the first CUF unit and meet the capacity and energy needs of the TVA system.

Solar resource additions would be needed to provide replacement energy for the TVA system. TVA is a dual-peaking utility, meaning that it could experience the highest annual peak days in the summer or in the winter. During the winter, the peak typically occurs around 7:00 a.m., when solar resources are not generating. As such, battery storage additions would be needed to provide year-round replacement capacity, especially in winter.

A generating facility's "**capacity factor**" is the ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produces at continuous full power operation during the same period.

While solar resources generate energy during daylight hours, this energy is both intermittent in nature and non-dispatchable. Unlike firm, dispatchable resources, such as natural gas-fired generation, solar resources are typically only available on average about 25 percent of the year, and their availability can ramp up or down significantly during daylight hours as cloud cover and precipitation events occur. Recent proposals for in-Valley, utility-scale single-axis tracking solar resources, as well as the experience in operating the solar facilities currently providing power to TVA, indicate an average annual capacity factor of approximately 25 percent. Therefore, to match the total energy output lost to the TVA system from the retirement of a CUF unit, a higher nameplate capacity would be required for a solar resource than the 1,450 MW minimum resource requirement for a fully dispatchable resource such as a CC or CT plant.

Additionally, new storage facilities would be required to provide dispatchable capacity to meet peak loads, as well as to store a portion of solar generation for use at other times, typically not exceeding a few hours, when needed. In both summer and winter peak seasons, the CUF units provide dependable capacity and energy for extended time periods. Oftentimes, high loads caused by warm or cold weather events can last for several days in a row, leading to difficulty in sufficiently recharging storage resources. As a result, storage resources would need to have a nameplate capacity that is higher than the 1,450 MW minimum resource requirement for a fully dispatchable resource in order to dependably meet system needs following the retirement of the first CUF unit.

2.1.5.2.1. Solar Plus Storage Evaluation and Reliability Analysis

TVA performed a reliability analysis to determine an appropriate combination of solar and storage resources to maintain year-round system reliability for Alternative C. TVA began the solar plus storage evaluation by determining the appropriate level of solar resources needed to replace the energy needs resulting from the retirement of the first CUF unit. Multiple years of history were used to determine an average annual capacity factor, approximately 25 percent, and resulting average annual energy output. TVA calculated the nameplate capacity of solar resources required to supply this same amount of annual energy. The resulting calculations indicated a need for approximately 3,000 MW of

nameplate solar to replace system energy provided by the first unit retirement at CUF. This 3,000 MW would be in addition to the approximately 10,000 MW of solar additions by the mid-2030s that are forecasted in TVA's current plans. Pairing solar with flexible, firm, dispatchable resources would provide a backstop to ensure system reliability is maintained during the hours that solar resources are not available, and during daylight hours when solar resources may quickly ramp up or down requiring a commensurate response from the system to maintain reliability.

The next step was to determine the amount of battery storage to pair with the additional 3,000 MW of solar capacity. TVA assumed that battery storage additions would be four hours in duration, as is typical for utility scale lithium-ion battery energy storage systems. To ensure year-round reliability, TVA performed a reliability analysis utilizing the Strategic Energy and Risk Valuation Model (SERVM) from Astrapé, which is the same model TVA utilizes when periodically updating its Reserve Margin Study. The objective function of the study was to determine the level of storage, paired with 3,000 MW of additional solar, needed to maintain an industry best practice level of reliability of one loss of load event (LOLE) every 10 years (or 0.1 LOLE), with this risk balanced evenly between summer and winter. The SERVM model accounts for uncertainties related to weather, load forecasts, and system performance. Modeling the retirement of the first CUF unit, study results indicated that approximately 1,700 MW of four-hour battery energy storage systems paired with 3,000 MW of additional solar will maintain a 0.1 LOLE with balanced seasonal risk. Based on this analysis, this EIS evaluates additions of 3,000 MW of solar capacity paired with 1,700 MW of battery storage for Alternative C. TVA has determined that although solar can also be paired with battery storage to achieve similar demand following capabilities, such a pairing is constrained in that lithium-ion batteries are energy limited, i.e., typically 4-hours in duration, and are net consumers of electricity with approximately 10–15 percent energy less from charge to discharge. The energy limited nature of battery storage makes Alternative C operationally challenged in its ability to meet required year-round generation needs, such as cold winter nights with sustained high electric loads longer than 4 hours and with no solar generation.

Battery storage is a new resource for TVA, with multiple projects either planned or under contract to occur in the next few years. The operating experience gained from these early projects will provide insight on how battery storage is utilized in the TVA system. As short-duration battery storage systems are added and become a larger part of the TVA power portfolio, the capacity credit (i.e., the percentage of nameplate capacity that is counted as firm, dispatchable capacity for meeting peak load requirements) for incremental battery additions will begin to decrease. This decreasing capacity value for short-duration storage has also been acknowledged by other peer utilities, and the exact decline in capacity credit will vary between utilities based on factors, such as when a utility experiences typical peak loads (i.e., summer, winter, or dual-peaking), the total and type of existing generating capacity on the system, electric load demand profiles, and other factors. Early battery experiences will further inform how battery storage is valued in TVA's future planning including, for example, in later planning for replacement generation for the second retiring CUF Unit.

2.1.5.2.2. Resource Procurement and Site Evaluation

TVA typically utilizes Power Purchase Agreements (PPAs) with third-party developers for its solar facilities. Since TVA also has the option to construct and own ("self-build") these facilities, solar and storage facilities constructed under Alternative C could be a combination of PPAs and self-built facilities. For modeling purposes, Alternative C assumes that TVA

continues its practice of soliciting competitive bids for new solar and storage PPAs to meet the need determined in this analysis. While site locations remain unknown, TVA anticipates that a large portion of these facilities would need to be physically located in the Middle Tennessee region to maintain grid reliability and stability. Power from these facilities would typically be delivered by direct connection to TVA's transmission system or via interconnections with local power companies that distribute TVA power to customers.

Solar and battery storage projects require large land acreage. Under Alternative C, TVA would construct and operate 3,000 MW of solar and 1,700 MW of battery storage at various sites, mostly within Middle Tennessee, which would require about 21,900 acres for the solar facilities and 640 acres for the battery storage facilities. Typical sites for the development of solar facilities are relatively flat to gently rolling and mostly cultivated cropland, pasture, or hayfields. Suitable sites typically have little on-site infrastructure and are in sparsely populated areas with compatible local zoning. Almost all TVA solar projects have affected farmland and resulted in changing the land use of farmed portions of the facility sites from agricultural to industrial. Depending on the generating capacity of the facility, the developed portion of the site may be over 1,000 acres.

2.1.5.2.3. Components of Solar and Storage Facilities

Solar facilities convert sunlight into direct current (DC) electrical energy within PV panels (modules) (Figure 2.1-12). PV power generation is the direct conversion of light into electricity at the atomic level. Some materials exhibit a property known as the photoelectric effect that causes them to absorb photons of light and release electrons. When these free electrons are captured, an electric current is produced, which can be used as electricity (TVA 2014, 2021d).

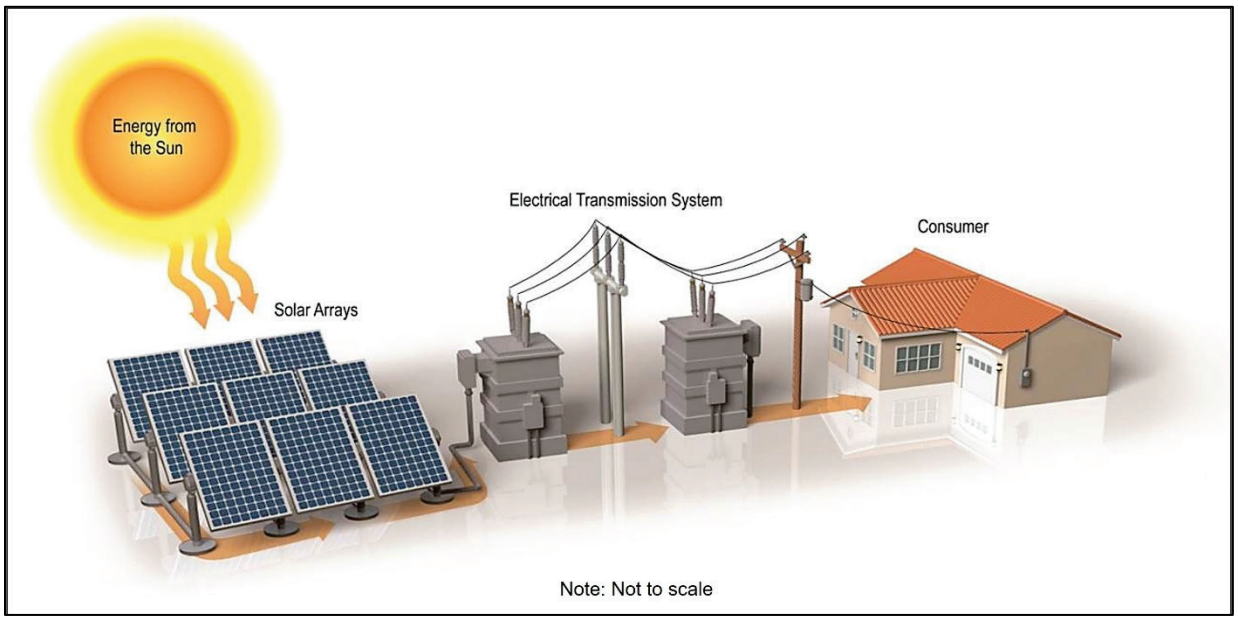

Figure 2.1-12. General energy flow diagram of PV solar system

Solar facilities would be composed of PV modules mounted together in arrays. Groups of panels would be connected electrically in series to form "strings" of panels, with the maximum string size chosen to ensure that the maximum inverter input voltage is not exceeded by the string voltage at the project's high design temperature. The panels,

estimated to be approximately 6.5 feet by 3.5 feet, would be located in individual blocks consisting of the PV arrays and an inverter station on a concrete pad or steel piles, to convert the DC electricity generated by the solar panels into AC electricity. The solar facility would be enclosed by chain-link security fencing. Apart from access roads, the portions of the project outside the fenced-in area are typically not developed.

The modules would be attached to single-axis trackers that follow the path of the sun from the east to the west across the sky (Figure 2.1-13). The inverter specification would fully comply with the applicable requirements of the National Electrical Code and Institute of Electrical and Electronics Engineers standards. Each inverter would be collocated with a medium voltage transformer, which would step-up the AC voltage to minimize the AC cabling electrical losses between the central inverters and the proposed on-site Project substation. Underground AC power cables would connect all of the medium voltage transformers to the main power transformer, located within the substation.

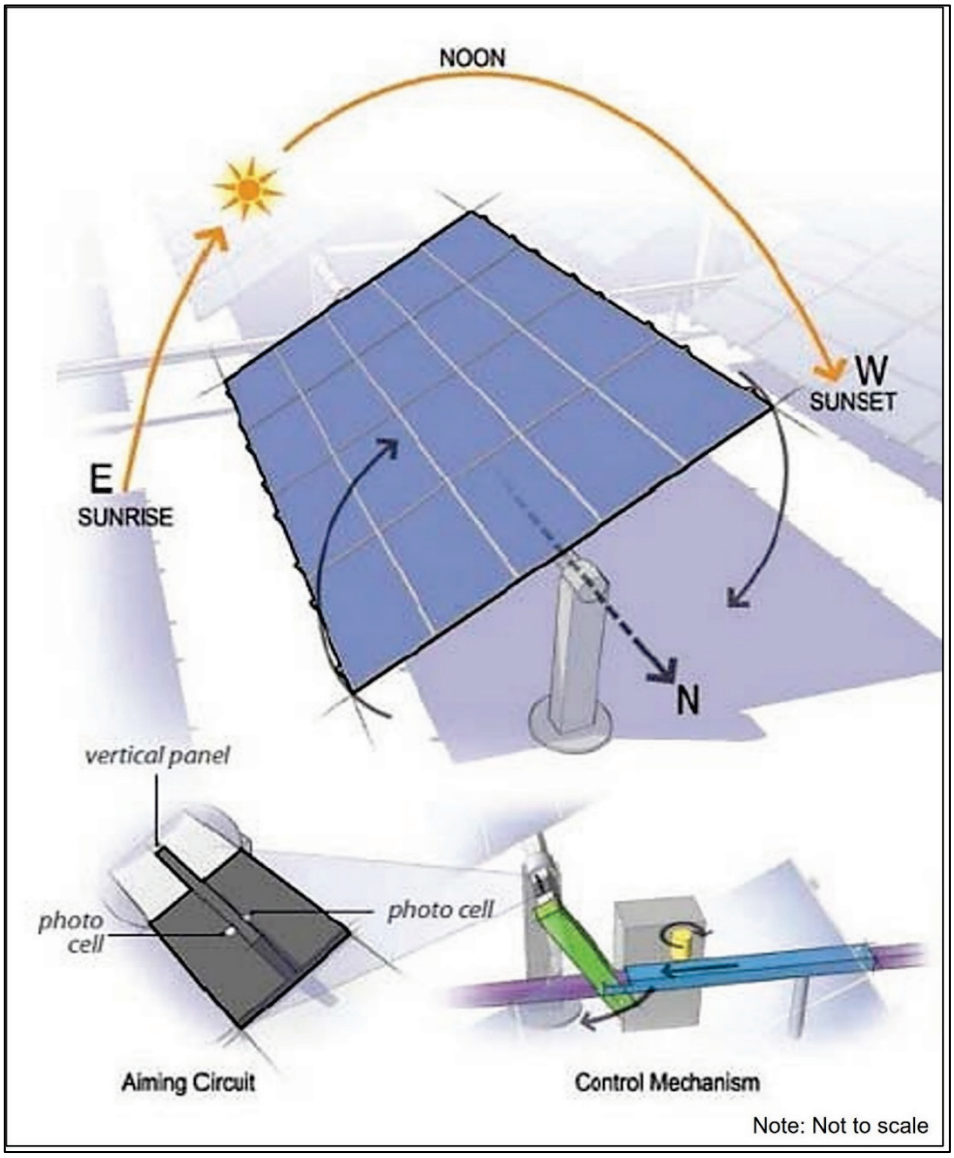

Figure 2.1-13. Diagram of single-axis tracking system

Other temporary or permanent project components would include construction laydown areas and security and communications equipment. Compacted gravel or native fill access roads would provide access to each inverter block and the proposed substation. Also, if determined necessary, the project would include project water wells, a septic system or pump-out septic holding tank, and an operations and maintenance building. Vegetation on individual solar facilities could be managed using intermittent mowing or grazing sheep.

Lithium-ion technology is the most common BESS and it is assumed to be the technology for the storage facilities that would be developed under this alternative. Storage facilities are typically small sites and sited near existing substations, transmission lines, or solar facilities. Construction would consist of grading the site and installing a foundation to place the battery containers, inverters, electrical and communications connections for the BESS and heating, ventilation, and air conditioning (HVAC) system monitoring and control. The battery containers are modular steel construction similar to intermodal shipping containers in which the modular lithium-ion battery cells are mounted on racks and connected by cabling. The battery containers are equipped with air conditioning and fire protection systems, auxiliary distribution board, and lighting.

2.1.5.2.4. Transmission and Electrical System Components

As noted above, if generation is not located at or near the Cumberland site, as would be the case for Alternative C, the transmission system will require significant investment to be upgraded at the alternative generation sites and surrounding areas.

Over the past several years, TVA has connected multiple solar facilities to TVA's transmission system. Most of these projects include transmission interconnection as well as network upgrades elsewhere on TVA's system. These network upgrades could include the construction of new TLs or upgrades to existing TLs to increase electrical capacity. The average length of new TL for solar facility connection at 31 solar projects of various capacities developed for TVA from 2014 to 2021 is 1.71 miles. The lengths ranged from 0 to 16 miles, with the majority being between 0 and 2 miles. The average number of acres impacted due to transmission and electrical system components ranged from 0 to 225 acres, with the average being 17.73 acres. Upgrades are typically performed to increase the electrical capacity of the existing TLs and would include the items listed in Section 2.1.4.4.1.

The anticipated amount of construction of new or upgraded transmission facilities would vary amongst each solar and/or storage project. All new generating and storage facilities would require connections to the transmission system, either directly or through an interconnection with a local power company. The length of connecting TLs and the need for new substations and switching stations would depend on the location and capacity of the facilities. Depending on the solar and battery site locations, line upgrades may be required to increase the capacity of existing TLs. Optical fiber ground wire may also need to be installed on TLs to facilitate the needed relay protection and operation of the facilities.

Since exact locations for solar and storage facilities are unknown at this time, detailed transmission requirements are undetermined. Significant transmission network upgrades to facilitate the delivery of power to the Nashville area would likely be required, including upgraded or new transmission lines and the addition of dynamic reactive devices.

The above information was compiled to provide an estimate of the potential effects associated with the construction of transmission and electrical system components to

support solar and storage facilities to provide a comparison to other action alternatives being considered in more detail. Exact site locations for solar and storage facilities are not known at this time; therefore, if Alternative C was pursued, additional site-specific tiered NEPA analyses would need to be completed as projects are identified and the scope is further defined.

The expected duration for the transmission work needed for Alternative C is 9 to 11 years. This timeframe could be subject to further delays given the current solar market's rising prices for commodities and numerous supply chain interruptions.

2.1.5.3. Alternative C Summary

Although Alternative C would provide the necessary replacement power through the construction and operation of 3,000 MW of solar photovoltaic generating facilities and 1,700 MW of battery energy storage facilities, Alternative C would not provide the firm, dispatchable generation needed to meet year-round generation. These facilities would be located at numerous sites totaling approximately 21,900 acres for the solar facilities and 640 acres for the battery storage facilities primarily in Middle Tennessee. TVA is currently adding additional solar capacity each year as it works towards 10,000 MW by 2035. To meet the necessary 2026 in-service date driven by the retirement of the first CUF unit, TVA would have to almost double its solar addition rate, which would strain TVA and contract resources in terms of their capital requirements, skilled workforce needs, transmission line outage scheduling, and ability for operations personnel to adjust procedures appropriately. Each of the facilities would also have to be connected to the TVA power grid.

While the transmission connections for these individual facilities are frequently no more than two miles, the addition of the proposed generating capacity would likely require numerous upgrades to existing transmission lines and could require lengthy new transmission lines and new substations. Because Alternative C would not provide the firm, dispatchable generation needed to meet year-round generation needs and because of the time that would be required for the associated transmission line work, estimated to be between 9–11 years, this alternative would not meet the necessary in-service date of 2026 for replacement generation and does not meet TVA's Purpose and Need.

2.1.6. Alternatives Considered but Eliminated from Further Discussion

TVA considered various resource types for replacement of generation lost because of retiring the first unit at CUF. The replacement generation must be capable of providing firm, dispatchable power. Considered resources were required to be capable of being constructed and operating by late 2026.

TVA's evaluation of the CUF Project tiers from the 2019 IRP EIS and aligns with the 2019 IRP findings and target supply mix. In addition to the proposed replacement generation, TVA expects to add 10,000 MW of solar generation by 2035 to meet customer demands and system needs. Integrating this significant number of intermittent resources requires a generation fleet that is highly flexible and capable of ramping up and down quickly to cover gaps in renewable generation.

TVA continuously monitors a variety of market conditions to inform its planning, including forecasts for loads, commodities, and resource costs. Higher demand expectations for residential and supporting services, such as data centers, is being driven by an observed shift in interstate migration patterns into the Valley that is expected to continue. Upon incorporating these trends, current TVA load forecasts points to slightly increasing peak

loads over the next 20 years. With the approved retirement of Bull Run Fossil Plant in 2023, TVA will be at minimum reserve targets and must therefore replace any retiring capacity with dependable capacity to maintain summer and winter load targets.

TVA considered the resource options listed in Table 2.1-5 to replace the first unit at CUF.

Table 2.1-5. Resource Alternatives Considered

Resource Option	Carried Forward for Detailed Review in EIS (Y/N)	Reasoning
Natural Gas-Fired CC	Y (used in Alternative A)	High fuel efficiency intermediate units with large energy potential and ability to provide grid support and follow load; relatively low construction cost; and fully dispatchable year-round with the ability to ramp up and down throughout the day to meet changes in demand and fluctuations in output from intermittent renewable resources
Natural Gas-Fired CT	Y (used in Alternative B)	Peaking units with the ability to start and ramp quickly on short notice as well as provide grid support and follow load; fully dispatchable year-round with the ability to meet capacity needs during short periods; lowest installed capital cost per MW and offers flexibility to assist in the integration of intermittent renewable resources
Battery Energy Storage System (BESS)	Y (used in Alternative C)	Represents one of the lowest cost storage options available at this time; while lithium-ion technology is most common, other technologies continue to be explored; provides dispatchable complement to intermittent nature of solar and wind resources; features a customizable output rating (stated in MW capacity) but is limited in duration of generation (stated in MWh); based on industry experience, four-hour BESS systems typically provide the optimal balance of price, output, and duration
Utility-Scale PV Solar	Y (used in Alternative C)	Carbon-free renewable resource; relatively inexpensive on a cost per megawatt hour (MWh) basis, with forecasts indicating continued declines in real dollars throughout the balance of the decade; not dispatchable and generation is intermittent based on daylight hours and weather patterns; requires large amounts of relatively flat land (7–10 acres per MW);must be paired with dispatchable resources, such as storage or gas-fired generation, in order to provide firm, dispatchable capacity
Hydro Pumped Storage	N	A long-duration storage technology that is currently being studied by TVA for further evaluation and potential deployment in the early 2030s; long duration storage becomes increasingly important to balance system demand needs as solar penetration on the system continues to increase; requires longer

Resource Option	Carried Forward for Detailed Review in EIS (Y/N)	Reasoning
		timelines to meet environmental requirements and to complete construction, which fail to meet the 2026 timeline for the first unit retirement at CUF
Small Modular Reactors	N	Carbon-free resource with potential to serve cost-effective baseload or load following needs in the future with low fuel costs, advanced passive safety systems, and anticipated cost reductions achieved by assembling components in a factory setting; requires longer timeline to meet regulatory requirements and complete construction; also introduces risks associated with “first of kind deployment,” which fails to meet the 2026 timeline for the first unit retirement at CUF
In- and/or Out-of-Valley Wind	N	Carbon-free renewable resource; can be relatively inexpensive on a cost per megawatt hour (MWh) basis in high-wind regions; however, the inclusion of required transmission reservation, wheeling, and/or congestion charges to less windy regions, such as the Tennessee Valley, can greatly increase this cost; can provide limited dependable capacity in both summer and winter, though intermittent; low wind speeds in Tennessee Valley and higher transmission costs for out-of-Valley wind result in this resource being less economically viable than competing resource options; therefore, it was not carried forward for more detailed review
Energy Efficiency (EE)	N	Demand-side resource which reduces electricity demand through the installation of efficiency measures to reduce energy use across hours; well-positioned to play a role in absorbing load growth resulting from increased electrification of the economy; EE programs take time to scale and market and face increasing costs at the high penetration levels required to meet the needs of this project
Demand Response (DR)	N	Demand-side resource which provides temporary on-demand load reduction during times of heavy electricity demand by issuing a “call” to contractually non-firm load; well-positioned to play a role in absorbing peak load growth resulting from increased electrification of the economy and allow TVA to offset physical capacity needs; DR is limited in the number of calls available and does not provide firm, dispatchable power; therefore, this option would not meet the needs of this project

Distributed generation, which could include a number of different resources, such as distributed solar, storage, and wind, was also considered. Distributed Energy Resources (DER) are generally smaller in size and can be aggregated together in a program or agreement for planning purposes. TVA's flexibility option, available to LPC Long-term Partners, provides an avenue for additional levels of DER by allowing LPCs to self-generate up to 5 percent of their annual load. TVA's IRP (TVA 2019a) includes assumptions for DER adoption, including DER added by LPCs on the distribution system. In general, the cost for distributed generation is higher than utility-scale generation for the same type of resource. TVA has therefore determined that the combination solution of utility-scale solar paired with utility-scale storage as presented in Alternative C provides a more feasible lower-cost solution for replacement generation and capacity utilizing renewable energy than distributed generation.

In addition, an alternatives analysis was conducted by TGP for the natural gas pipeline component of Alternative A. In this alternatives analysis, the options in Table 2.1-6 were considered as alternatives to the proposed 32-mile, 30-inch diameter pipeline. Additional details about these potential alternatives are presented in TGP's Resource Report 10, Alternatives (TGP 2022j).

Table 2.1-6. Potential Alternatives to the Proposed Pipeline Route

TGP Options	Selected (Y/N)	Reasoning
No Action	N	TGP would not be able to meet TVA's stated need to provide up to 245,040 Dth/d of firm transportation capacity to serve Alternative A.
Energy Conservation	N	The implementation and success of energy conservation in curtailing energy use is a long-term goal, extending well beyond the timeframe of the proposed pipeline. Further, energy conservation would not allow TGP to provide up to 245,040 Dth/d of firm transportation service to the Cumberland CC plant as would be needed under Alternative A.
24-Inch-Diameter Pipeline and Booster Compression Station	N	Construction impacts would be the same as the proposed 30-inch diameter pipeline. However, due to the need for additional compression, this alternative would result in temporary impacts to an additional 50 acres and permanent impacts to an additional 10 acres of land. In addition, the compressor station would generate emissions which would not occur under the proposed pipeline. Also, due to the additional need for compression, this alternative would cost more than the proposed pipeline and would take longer to construct, potentially impacting the 2026 in-service date. For these reasons, this alternative was eliminated from further consideration.
30-Inch-Diameter Pipeline Lateral and Booster Compression Station Commencing at Portland	N	This 65-mile pipeline would result in greater environmental impacts and not take advantage of being adjacent to an existing utility corridor, see TGP Resource Report 10 (TGP 2022j). It would also cross the Barkley Recreation Area. Due to the need for additional compression, this alternative also results in increased emissions . Compared to the proposed pipeline, it would also be considerably more costly and take longer to construct, potentially impacting the

TGP Options	Selected (Y/N)	Reasoning
Compressor Station 87		2026 in-service date. For these reasons, this alternative was eliminated from further consideration.
24-Inch-Diameter Pipeline and Booster Compressor Station Commencing at Mainline Valve 83	N	The impacts of this potential alternative, which includes a 41.6-mile pipeline, are similar to those of the previous potential alternative commencing at Portland Compressor Station 87. In addition to crossing Barkley Recreation Area, it would also cross the Tennessee Wildlife Resource Agency-managed Shady Park Public Hunting Area. For these reasons, including the longer construction time, this alternative was eliminated from further consideration.
Other Pipeline Company Alternatives: ANR Pipeline Company	N	This potential alternative pipeline would have a minimum length of about 45 miles and approach CUF from the northwest. It would cross Cross Creeks National Wildlife Refuge, Stewart State Forest, and Lake Barkley Recreational Area, as well as numerous wetland areas along the Cumberland River. Its options for co-location with existing utility easements are limited. Because of these likely greater environmental impacts, more affected property owners, and increased cost and longer construction time, it was eliminated from further consideration
Other Pipeline Company Alternatives: East Tennessee Natural Gas, LLC	N	This potential alternative pipeline, with a minimum length of about 40 miles, would approach CUF from the south. Compared to the proposed pipeline, it would affect more private landowners, impact a larger area of wetlands, cross more water bodies, including the Duck River, and have more limited options for co-location with existing utilities. It would also be costlier and take longer to construct. For these reasons, it was eliminated from further consideration.

Source: TGP 2022j

TGP also considered alternative sites for the pressure regulation station and Cumberland meter station (TGP 2022j). Alternative sites for the pressure regulation station were limited by the need to be as close as possible to the proposed pipeline's junction with the TGP 100-3 and 100-4 tie-in and the proximity of the TVA transmission line and nearby residences, as well as other factors. The selected location best meets the siting criteria including minimizing impacts to nearby residences, with a wooded area providing visual screening and a sound barrier.

The Cumberland meter station site is located on the CUF reservation on the CC plant site. Siting criteria included its integration with the CC plant components as well as access to the site for construction, operation, and maintenance activities. Given TVA's proposed location of the CC plant, there were few alternative sites for the meter station. The selected site would be largely surrounded by other CC plant components and about 1,700 feet north of the nearest residence.

TGP has made and continues to consider multiple minor variations to the pipeline alignment in response to engineering, environmental, and landowner concerns. This EIS addressed the potential impacts of the pipeline based on the information currently available.

2.1.6.1. Blended Alternatives Considered but Eliminated from Further Discussion

Although the DEIS evaluated a solar and battery storage alternative in Alternative C, commenters on the DEIS recommended that TVA consider a blended alternative that blends energy efficiency and demand response measures with renewable energy resources, such as solar and energy storage. However, TVA's asset strategy already contemplates the blending of resources to provide the least-cost, optimal portfolio under a variety of future conditions. The preferred alternative in this EIS is a specific, discrete component of that blend reflected in TVA's asset strategy. TVA's long-term planning, specifically the 2019 IRP, accounts for the integration of renewables on a schedule that best balances economics, reliability, and environmental impacts, while staying consistent with the least-cost planning requirements of 16 U.S.C. § 831m-1(b)(1).

Even if TVA were not already planning for a system-wide blend that includes the addition of significant renewable generation, any blended alternative TVA analyzed in this asset-specific EIS would have a substantial renewable/storage component and would require similar transmission work and durations (i.e., 9–11 years) associated with Alternative C. Therefore, any such blended alternative would not meet the purpose and need to have 1,450 MW of firm, dispatchable operation in commercial operation by 2026.

One commenter suggested consideration of a blended alternative that combines a lower amount of natural gas with other technologies, such as solar and battery storage. While there are many such potential blended alternative combinations that TVA could consider, any such blended alternative would have a substantial solar and storage component, which would raise the same issues with transmission work and durations as Alternative C and therefore would not meet the purpose and need to have 1,450 MW of firm, dispatchable operation in commercial operation by 2026. One potential blended option would consist of 1,200 MW of solar and 700 MW of battery storage paired with a 884-MW 4-unit CT plant at Johnsonville, comparable to the Alternative B CT plant at Johnsonville. The solar and battery interconnections would likely require a minimum of six years to complete. Further, these solar and battery interconnections would be in addition to the solar/battery installations TVA is already planning. Resource additions at this scale would strain TVA and contract resources in terms of their capital requirements, skilled workforce needs, transmission line outage scheduling, and ability for operations personnel to adjust procedures appropriately.

Accordingly, after careful consideration, TVA has determined that blended alternatives would not meet the project purpose and need for a number of reasons and, therefore, is not evaluating blended alternatives other than Alternative C in more detail in the FEIS.

2.1.6.2. Alternative Fuels and Carbon Capture and Sequestration Considered but Eliminated from Further Discussion

Combustion turbine units, used in combined cycle (CC) or in simple cycle (CT) operations, hold promise in further contributing to a net-zero future through the use of alternative fuels, such as hydrogen and/or carbon capture and sequestration (CCS) technology. Most modern combustion turbine units available today have the capability to burn a blend of hydrogen in combination with fossil fuels to reduce the unit's carbon footprint. It is anticipated that this capability will continue to advance and increase the percentage of alternative fuel blending or exclusive alternative fuel use that these units will be capable of in the future. CCS systems typically work by capturing carbon emissions before being released into the atmosphere, transporting them, and then storing them in underground

geological formations. Given cost considerations, CCS technology would likely be paired with higher capacity factor units, such as those in combined cycle configuration. At this time, high costs and immaturity of alternative fuels and CCS remain barriers to widespread commercial use. TVA has considered the USEPA's draft whitepaper on reducing GHG emissions from combustion turbines (USEPA 2022b) and anticipates the efficiency, effectiveness, scalability, and economics of these systems to improve in the next several years, allowing for more informed decisions in the future when adequate storage locations or pipelines are identified for both delivery of hydrogen and the storage or use of captured CO_2. TVA is exploring partnerships with federal agencies and peer utilities to advance the research and development of both alternative fuels and CCS technology, which could enable their use at existing or future TVA facilities. Given current cost and maturity challenges with alternative fuels and CCS, these options were not considered viable within the time frame proposed for the first unit retirement at CUF and therefore are not considered in more detail in this EIS.

As discussed in more detail in Section 2.3.2 below, TVA is evaluating CCS and combustion of hydrogen as potential future mitigation for Alternative A and plans to ensure that plant design would enable future modifications for carbon capture and the combustion of hydrogen as a replacement or supplemental fuel for natural gas as the technologies mature.

2.2. Comparison of Alternatives

Impacts evaluated may be beneficial or adverse and may apply to the full range of natural, aesthetic, historic, cultural, and socioeconomic resources within the project areas of each alternative and within the surrounding areas. Impact severity is dependent upon their relative magnitude and intensity and resource sensitivity. In this document, four descriptors are used to characterize the level of impacts in a manner that is consistent with TVA's current practice.

In order of degree of impact, the descriptors are as follows:

- No Impact (or "absent") – Resource not present or, if present, not affected by project alternatives under consideration.
- Minor – Environmental effects are not detectable or are so minor that they would not noticeably alter any important attribute of the resource.
- Moderate – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- Significant – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

A comparison of the environmental consequences associated with each alternative is presented in Table 2.2-1.

Table 2.2-1. Summary and Comparison of Alternatives by Resource Area

Resource Area	No Action Alternative	All Action Alternatives	Alternative A	Alternative B	Alternative C
Environmental Justice	Minor adverse effect possible from potential rate increases which would be amplified on low-income ratepayers	Minor beneficial long-term impacts from positive effects to water quality, air quality, and aquatic life due to retirement; Potential for EJ populations to experience amplified temporary adverse effects from impacts to surface water, air quality, aquatic life, recreation, transportation, utilities, waste, safety, socioeconomics, noise, and visual aesthetics due to D4 activities; Minor cumulative adverse effects possible if the D4 and CCR management construction occur at the same time	Minor beneficial effects from beneficial impacts to recreation and socioeconomics; Potential for adverse effects experienced by EJ populations to be amplified, specifically for adverse effects to surface water, waste, safety, noise, transportation, and visual aesthetics. Minor cumulative impacts on EJ populations due to pipeline construction.	Minor beneficial effects from positive impacts to socioeconomics; Potential minor adverse effects to recreation, air quality, transportation, waste, noise, and visual aesthetics. EJ populations may experience amplified effects from impacts to these resources. Future evaluation of potential adverse effects and impacts on EJ populations needed for transmission activities. Minor adverse effect possible from potential rate increases which would be amplified on low-income ratepayers	Beneficial effects from positive impacts to socioeconomics and air quality;; Potential adverse effects to land use, vegetation, recreation, water resources, wildlife, transportation, noise, and safety, and visual aesthetics; EJ populations may experience amplified effects from impacts to these resources. Possible cumulative effects; Future evaluation of severity and proportionality of effects needed for individual solar/storage/transmission activities. Minor adverse effect possible from potential rate increases which would be amplified on low-income ratepayers
Land Use	No direct or indirect project-related effects.	Moderate temporary effects during demolition of the existing CUF facilities. Insignificant long-term impacts due to maintained industrial nature of site. Moderate permanent direct effects from land/habitat conversion during construction of the CC facilities, transmission lines, and the gas pipeline.	Minor temporary effects during construction. Conversion of hay/pastureland within the CC Plant site to developed land for construction. Temporary land disturbance and permanent land conversion and restrictions on future uses as a result of pipeline and TL construction.	JCT: Negligible temporary effects during construction. Gleason: Direct effects in conversion of undeveloped land during construction. Transmission Line: Direct effects in conversion of land to transmission line right-of-way.	Minor temporary effects during construction. Moderate effect in conversion of agricultural land to developed land with potential for later restoration of agricultural use.

Resource Area	No Action Alternative	All Action Alternatives	Alternative A	Alternative B	Alternative C
Geology	No direct or indirect project-related effects.	Minor direct effects to geology during demolition.	Minor direct effects to geology during construction. Minor potential for seismic activity. Geologic features, such as sinkholes or karst terrain, would be avoided or mitigated.	Minor direct effects to geology during construction. Minor potential for seismic activity. Geologic features, such as sinkholes or karst terrain, would be avoided.	Minor direct effects to geology during construction. Minor potential for seismic activity. Geologic features, such as sinkholes or karst terrain, would be avoided.
Soils	No direct or indirect project-related effects.	Minor temporary effects during demolition.	Minor temporary direct effects to soil stability that would be reduced using appropriate BMPs.	Minor direct effects to soil stability that would be reduced using appropriate BMPs.	Minor direct effects to soil stability that would be reduced using appropriate BMPs.
Prime Farmland	No direct or indirect project-related effects.	No direct or indirect project-related effects.	Minor direct effects from loss of on-site prime farmland soils at CC plant and in pipeline corridor. There would be a minor, permanent effect to 0.2 acres of prime farmland from the construction of the Cumberland meter station.	JCT: Minimal to negligible direct effects to approximately 10.1 acres of previously disturbed and developed prime farmland. Gleason: Minimal to negligible direct effects to approximately 15.0 acres of previously disturbed and developed prime farmland. 40-mile TL: Minimal direct effects and no adverse cumulative effects anticipated but would require additional NEPA analysis.	Temporary to permanent moderate direct effects from loss of on-site prime farmland soils for a large portion of the approximately 21,900 acres of solar facilities and between 425 and 638 acres required for battery storage.

Resource Area	No Action Alternative	All Action Alternatives	Alternative A	Alternative B	Alternative C
Floodplains	No direct or indirect project-related effects.	Minor direct effects in the 100-yr floodplain that would be reduced using appropriate BMPs.	Temporary impacts to 48 acres and permanent impacts to five acres of 100-year floodplain as a result of CC Plant and barge unloading area construction. Temporary impacts to 102 acres of 100-year floodplain as a result of pipeline construction.	No floodplain impacts on JCT site. Temporary impacts to 100-year floodplain as a result of Gleason plant construction.	Potential for minor direct effects in the 100-yr floodplain that would be reduced using appropriate BMPs.
Groundwater	Minor effects from ongoing CCR activities that would be reduced using appropriate BMPs.	Risk of minor, temporary adverse impacts during D4 activities. Long-term beneficial effects. Minor cumulative effects possible based on CCR activities and Reasonably Foreseeable Future Actions (RFFAs).	Potential for minor effects during construction and potential for cumulative effects from multiple construction projects and increased traffic near the Project	Minor, temporary effects during construction. Minor and temporary indirect or cumulative effects.	Minor, temporary effects during construction.

Resource Area	No Action Alternative	All Action Alternatives	Alternative A	Alternative B	Alternative C
Surface Water and Water Quality	No Effect	Direct, temporary effects to water quality from mooring cell demolition and barge dock upgrades, and indirect effects from the demolition of the existing coal plant facilities. Permanent effects to the shoreline of Cumberland River related to barge dock upgrades. Long-term beneficial effect from reduced cooling water withdrawals. Short term, temporary and minimal effects to surface waters during demolition. BMPs would be employed where appropriate.	Permanent fill effects to ephemeral channels within CC plant footprint. Moderate, temporary effects during construction of pipeline due to dry open cut crossings. BMPs would be implemented to minimize effects to the greatest extent possible.	No permanent or long-term impacts to surface waters on JCT Reservation. Potential direct, permanent effects to one intermittent stream on Gleason Reservation. Siting of the CT plant would be designed to avoid and minimize effects to the greatest extent practicable. Possible minor, temporary effects to water quality during construction; BMPs would be implemented to minimize effects to the greatest extent possible. Potential for moderate permanent effects if onsite surface waters cannot be avoided.	Minor direct or permanent effects; siting of the solar facilities would be designed to avoid and minimize effects to the greatest extent practicable. Minor, temporary effects during construction. BMPs would be implemented to minimize effects from construction activities. Potential for cumulative effects. Potential for moderate permanent effects that would be determined during a supplemental NEPA analysis.
Wetlands	No Effect	No direct or indirect effects.	Minor, temporary effects during construction/ pipeline installation. Moderate, permanent effects due to conversion of wetland habitat types and cumulative effects from RFFAs. BMPs would be implemented to minimize construction effects to the greatest extent possible.	No effects on JCT or Gleason Reservation. Moderate, permanent effects to wetlands due to wetland type conversion in transmission corridor. BMPs would be implemented to minimize construction effects to the greatest extent possible.	Minor direct or permanent effects; siting of the solar facilities would be designed to avoid and minimize effects to the greatest extent practicable. Minor, temporary effects during construction. BMPs would be implemented to minimize effects from construction activities. Potential for cumulative effects.

Resource Area	No Action Alternative	All Action Alternatives	Alternative A	Alternative B	Alternative C
Vegetation	No Effect	Minor, temporary effects during demolition.	Direct temporary and long-term effects during construction; indirect effects from land disturbance (i.e., invasive species spread). Direct permanent effects through land conversion within ROWs. Cumulative effects from forest conversion to managed ROW.	Minor, temporary effects during construction. Direct permanent effects through clearing and maintenance of TL ROW (habitat conversion). Minimization of effects through Office-Level Sensitive Area Review (O-SAR).	Direct and indirect effects from habitat conversion. Cumulative effects from land conversion.
Wildlife	No Effect	Minor, temporary effects (disturbance) and permanent effects (habitat loss) during demolition.	Minor, temporary effects during construction. Moderate, permanent effects from forest conversion to managed ROW.	Minor, temporary effects during construction. Direct permanent effects through habitat conversion within TL ROW.	Minor, temporary effects during construction. Long-term, permanent effects from habitat conversion.
Aquatic Life	No Effect	Long-term beneficial effects from elimination of organism entrainment & impingement.	Minor, temporary effects during barge dock upgrades. Minor, temporary effects during pipeline installation.	Potential direct, permanent effects to habitat (one intermittent stream) on Gleason Reservation. Siting of the CT plant would be designed to avoid and minimize effects to the greatest extent practicable Minor, temporary effects during construction of CT plants or TL ROW.	Minor, temporary effects during construction. Permanent effects possible if streams are directly and permanently impacted.

Resource Area	No Action Alternative	All Action Alternatives	Alternative A	Alternative B	Alternative C
Threatened and Endangered Species	No Effect	Not Likely to Adversely Affect Protected Species.	No effect or unlikely to adversely affect listed species due to CC plant upgrades (USFWS concurrence). Adverse effects to bats due to habitat loss, accounted for through existing Biological Opinion. Not likely to adversely affect species due to construction of the natural gas pipeline.	JCT: Not Likely to Adversely Affect Protected Species. Gleason: Adverse effects to some bats due to potential for small area of forest removal. Not Likely to Adversely Affect remaining Protected Species. Potential for effects and required USFWS consultation for TL construction.	Adverse effects to some bats due to forest removal. Not Likely to Adversely Affect remaining Protected Species. Potential for effects and required USFWS consultation for solar facility and TL construction.
Natural Areas, Parks, and Recreation	No direct or indirect project-related effects.	Minor short-term effects during demolition. Minor long-term effects to recreation activities currently hosted onsite.	Short-term adverse effects but long-term beneficial effects to recreational areas (fishing, boating) adjacent to the CUF site (barge unloading area).	Minor temporary effects.	Unlikely to adversely affect natural areas, parks, or recreation.
Noise	No direct or indirect project-related effects.	Short-term, minor effects during demolition.	Short-term, minor effects during construction.	Short-term, minor effects during construction.	Short-term, minor effects during construction.
Visual	No direct or indirect project-related effects.	Short-term, minor effects during demolition. Long-term beneficial effects to viewshed.	Short-term, minor effects during construction. Long-term effects due to pipeline easement construction.	Short-term, minor effects during construction. Long-term effects from TL ROW maintenance.	Short-term, minor effects during construction. Likely long-term effects post-construction depending on original visual character of the sites selected.
Air Quality, GHGs	No direct or indirect project-related effects.	Short-term, minor effects during demolition. Long-term, beneficial effects.	Short-term, minor effects during construction. Long-term, beneficial effects.	Short-term, minor effects during construction. Long-term, beneficial effects.	Short-term, minor effects during construction. Long-term, beneficial effects.

Resource Area	No Action Alternative	All Action Alternatives	Alternative A	Alternative B	Alternative C
Regional Climate	No direct or indirect project-related effects.	No appreciable direct or indirect project-related effects.	Increases in ambient temperatures due to climate change would have minor negative impacts to combustion turbine efficiency. Operational effects due to flooding or drought conditions are not expected to be significant. Long-term, beneficial effects on regional climate.	Increases in ambient temperatures due to climate change would have minor negative impacts to combustion turbine efficiency. Operational effects due to flooding or drought conditions are not expected to be significant. Long-term, beneficial effects on regional climate.	Increases in ambient temperatures due to climate change would have minor negative impacts to equipment efficiency. Operational effects due to flooding or drought conditions are not expected to be significant. Long-term, beneficial effects on regional climate.
Cultural Resources	No direct or indirect project-related effects.	No direct or indirect project-related effects.	No direct effects to significant cultural resources within the impact area. Traffic-related construction effects to the NRHP Henry Hollister House would be avoided or minimized by routing truck traffic along Old Scott Road from the south. Direct adverse visual effects to the Henry Hollister House from the proposed CC plant/transmission infrastructure would be mitigated through the MOA signed with the SHPO on September 22, 2022.	No direct effects to cultural resources at JCT as it would be located on a previously disturbed site. No effects to historical architectural structures. Effects to cultural resources at Gleason unknown, pending cultural resources survey.	Impact avoidance likely if significant cultural resources can be avoided in site selection.
Utilities	No direct or indirect project-related effects.	Long-term effects to buried utilities. No effects to switchyards.	Long-term, beneficial effects due to decreased water use. Temporary, minor adverse impacts due to risk of temporary waterline shutoffs during pipeline construction.	Long-term, beneficial effects.	Long-term, beneficial effects.

Resource Area	No Action Alternative	All Action Alternatives	Alternative A	Alternative B	Alternative C
Waste Management	No direct or indirect project-related effects.	Short-term, minor effects due to the limited potential for hazardous waste to be discharged and/or released into the environment during demolition activities.	Temporary increase in generation of hazardous waste during construction. Long-term generation of waste at CC plant; overall, significant decrease in long-term amount of waste generated compared to coal plant.	Temporary increase in generation of hazardous waste during construction. No long-term change in waste at JCT and Gleason CT plants.	Temporary increase in generation of hazardous waste during construction.
Public Health and Safety	The continued combustion of coal and associated wastes would incur risks to worker safety. No other project-related effects on public health and safety would result.	Short-term, minor effects during demolition. Long-term beneficial effects to worker safety.	Short-term, minor effects during construction. Long-term benefit to public health through air quality improvement.	Short-term, minor effects during construction.	Short-term, minor effects during construction.
Transportation	No direct or indirect project-related effects.	Short-term, minor effects during demolition. Long-term beneficial effects.	Short-term, minor effects during construction and long-term, beneficial effects during operations.	Short-term, minor effects during construction.	Short-term, minor effects during construction.
Socioeconomics	No direct or indirect project-related effects.	Permanent, minor direct and indirect employment loss due to CUF closure.	Long-term employment loss from CUF closure would be offset by new employment options due to construction and operations of the CC plant and the pipeline.	Long-term employment loss from CUF closure would be offset by new employment options due to construction and operations of the CT plants.	Anticipated temporary beneficial effects to local population numbers; temporary and permanent beneficial effects to local employment; temporary indirect beneficial effects to the local economy; and long-term beneficial effects to the local tax base.

2.3. Identification of Mitigation Measures

TVA would employ standard practices and routine measures and other project-specific measures to avoid and minimize effects to resources from implementation of the Proposed Action Alternatives. Minimization and mitigation measures were provided by TDEC as recommendations regarding demolition materials in lieu of open burning, such as beneficial reuse or transport to a recycling facility or landfill; general permitting; and BMP guidance regarding cultural, air, and water resources.

TVA's siting processes for generation and transmission facilities, as well as practices for modifying these facilities, are designed to avoid and/or minimize potential adverse environmental effects. Potential effects are also reduced through standard pollution prevention measures and environmental controls, such as air pollution control systems and wastewater treatment systems. Other potentially adverse effects can be mitigated by measures, such as avoidance of sensitive areas; compensatory wetland mitigation; payments to in lieu stream mitigation programs and related conservation initiatives; enhanced management of other properties; documentation and recovery of cultural resources; and infrastructure improvement assistance to affected local communities.

TVA would implement minimization and mitigation measures. These have been developed with consideration of BMPs, permit requirements, and adherence to erosion and sediment control plans. TVA would utilize standard BMPs to minimize erosion during construction, operation, and maintenance activities. These BMPs are described in *A Guide for Environmental Protection and BMPs for TVA Construction and Maintenance Activities – Revision 4* (TVA 2022a) and the *Tennessee Erosion and Sediment Control Handbook* (TDEC 2012).

2.3.1. Standard practices and routine mitigation measures

In association with the potential construction of an Action Alternative, TVA would employ standard practices and specific routine measures to avoid and minimize effects to resources. During development of the EIS, TVA has considered implementation of the following minimization and mitigation measures in relation to potentially affected resources:

Soils

- Install silt fence along the perimeter of areas cleared of vegetation.
- Implement other soil stabilization and vegetation management measures to reduce the potential for soil erosion during site operations.
- Try to balance cut-and-fill quantities to alleviate the transportation of soils offsite during construction.

  TGP would follow the Karst Hazards Mitigation Guidance Plan (Appendix 6.D of TGP Resource Report 6), which provides practical solutions to address typical karst features, hydrotechnical hazards, and steep slopes, where site-specific mitigation plans are deemed unnecessary.

Water Resources

- Perennial, intermittent, and ephemeral streams and wetlands that could be affected by the proposed construction would be protected by implementing standard BMPs as identified in TVA's BMP manual and the *Tennessee Erosion and Sediment Control Handbook*. Direct, permanent effects to streams and wetlands would be permitted and mitigated under the CWA Section 404 permit and TDEC ARAP/ CWA

Section 401. In particular, TVA would purchase mitigation credits within the Cumberland and Tennessee River watersheds, as appropriate and to the extent such credits are available within these watersheds. Should mitigation credits not be available within the primary or applicable secondary watersheds, TVA would pursue mitigation through in-lieu fee credit purchases or through permittee-responsible mitigation.

- Comply with the terms of the individual NPDES permit for industrial wastewater discharge(s) by ensuring any proposed process water discharge meets applicable effluent limits and water quality standards, as identified in the NPDES permit.
- Comply with the terms of the erosion and sediment control plans prepared as part of the NPDES permitting process.
- Use TVA BMP procedures for controlling soil erosion and sediment control, such as the use of 50-foot buffer zones surrounding perennial and intermittent streams and wetlands; impaired or high- quality designated water features may require larger buffer zones and the installation of erosion control silt fences and sediment traps; and
- Implement other routine BMPs as necessary, including:
    - Non-mechanical tree removal within stream and wetland buffers;
    - Placement of silt fence and sediment traps along buffer edges;
    - Selective herbicide treatment to restrict application near receiving water features;
    - Proper vehicle maintenance to reduce the potential for adverse effects to groundwater; and
    - Use of wetland mats for temporary crossing, dry season work across wetlands, and no soil rutting of 12” or more in wetlands.

Biological Resources

- Revegetate with native and/or noninvasive vegetation consistent with EO 13112 (Invasive Species), including species that attract pollinators, to reintroduce habitat, reduce erosion, and limit the spread of invasive species.
- In areas requiring chemical treatment, only USEPA-registered and TVA-approved herbicides would be used in accordance with label directions designed, in part, to restrict applications near receiving waters and to prevent unacceptable aquatic effects. TVA would apply for coverage under TDEC’s NPDES General Permit for Application of Pesticides prior to use of herbicides in aquatic environments.
- Follow USFWS recommendations regarding biological resources and pollinator species:
    - Use of downward and inward facing lighting to limit attracting wildlife, particularly migratory birds and bats;
    - Instruct construction personnel on wildlife resource protection measures, including applicable federal and state laws such as those that prohibit animal disturbance, collection, or removal, the importance of protecting wildlife resources, and avoiding unnecessary vegetation removal; and

  - Perform surveys of buildings prior to demolition to ensure they have not been colonized by bats or migratory birds. If bats are found, including those listed as threatened or endangered species, these buildings would not be demolished until one of two mitigation actions occurs: 1) bats are transitioned out of the buildings, or 2) consultation with USFWS is completed. If active nests of migratory birds are present and demolition activities must occur within the nesting season, TVA would coordinate with USFWS, which assists with managing any potential effects to birds, to determine best options for carrying out demolition activities.
- Should actions near nesting osprey rise to levels above normal routine disturbance typically encountered on CUF, USDA-Wildlife Services will be contacted to ensure compliance under federal law.
- TVA would remove trees between November 15 and March 31 when listed bat species are not expected to be roosting in trees and when most migratory bird species of conservation concern are not nesting in the region.
- For those activities with potential to affect listed bats, TVA would commit to implementing specific conservation measures previously approved by USFWS through TVA's programmatic consultation to ensure effects would not be significant. Relevant conservation measures that would be implemented as part of the approved project are listed in the bat strategy form. The bat strategy form is in included as Appendix L.
- TVA would seek to sell any marketable timber generated from onsite clearing activities. Non-marketable timber may be cut and left in place in specified, non-wetland areas as a windrow BMP or may be chipped and used as sediment barriers or mulch.

Cultural Resources

- Keep access routes and construction activities outside of the 30-meter buffers surrounding any archaeological sites listed in, or eligible or potentially eligible for listing in, the NRHP.
- When access routes must be placed within such buffers, avoid modifications and use wetland mats and light-duty equipment when practicable.
- Locate new structures and buildings at least one-half mile from, and out of view of, any NRHP-listed or –eligible historic architectural structures, when practicable. When avoidance is not practical, mitigation will be performed in consultation with the SHPO.
- Plant vegetative screening to prevent clear views from any NRHP-listed or –eligible above-ground resources to the proposed new facilities or structures.

Waste Management

- Develop and implement a variety of plans and programs to ensure safe handling, storage, and use of hazardous materials.

Public and Occupational Health and Safety

- Implement BMPs for site safety management to minimize potential risks to workers.

Transportation

- Implement staggered work shifts during daylight hours and a flag person during the heavy commute periods to manage construction traffic flow near the project site(s), if needed.

Noise

- Minimize construction activities during overnight hours, where possible, and ensure that heavy equipment, machinery, and vehicles utilized at the project site meet all federal, state, and local noise requirements.

Visual

- Use of downward- and inward-facing lighting.

Air Quality and GHG Emissions

- Comply with local ordinances or burn permits if burning of vegetative debris is required and use BMPs, such as periodic watering, covering open-body trucks, and establishing a speed limit to mitigate fugitive dust (TVA 2021f).
- Remove ash from the facilities proposed for deconstruction and demolition, prior to removal of that facility and implement dust control measures during demolition to prevent the spread of dust, dirt, and debris to minimize potential fugitive dust mobilization associated with explosive demolition. These methods may include wetting equipment and demolition areas, covering waste or debris piles, using covered containers to haul waste and debris, and wetting unpaved vehicle access routes during hauling. Wet suppression can reduce fugitive dust emissions from roadways and unpaved areas.
- Maintain engines and equipment in good working order (TVA 2021f).
- Comply with TDEC Air Pollution Control Rule 1200-3-8, which requires reasonable precautions to prevent PM from becoming airborne. If necessary, emissions from open demolition areas and paved/unpaved roads could be mitigated by spraying water on the work areas and roadways to reduce fugitive dust emissions (TVA 2021f).
- Comply with the USEPA mobile source regulations in 40 CFR Part 85 for on-road engines and 40 CFR Part 1039 for non-road engines, requiring a maximum sulfur content in diesel fuel of 15 ppm.
- Follow routine capture and recycling procedures for gaseous materials produced by vehicles and demolition equipment.
- Follow the applicable USEPA emissions standards for locomotive engines and marine diesel engines.
- Implement emissions controls for NO_x and CO, and meet emissions limitations for SO_2 and CO_2 emissions, in accordance with 40 CFR 60 Subparts KKKK and TTTT for CC Plants, including emissions monitoring and/or performance testing requirements, fuel and fuel sulfur monitoring requirements, maintenance, recordkeeping, and reporting requirements. Use a Selective Catalytic Reduction (SCR) system located within the HRSGs for additional NO_x reduction. Reduction of CO emissions would be achieved using a separate catalyst layer specifically for that pollutant. The new exhaust stacks would be equipped with continuous emissions monitoring systems.

- Reduce NO_x emissions from the CTs (HRSG bypass operations) through dry low-NO_x combustion systems.
- Utilize efficient operation and maintenance techniques and leak detection to minimize sulfur hexafluoride emissions associated with transmission construction and upgrades.

Blasting/Explosives

- TVA would work to minimize one-time emissions of fugitive dust from facilities expected to produce large volumes (such as demolition of the stack) by working with the demolition contractor on a site-specific plan. The plan may use mitigation methods that include the treatment of fall zones, misting, and application of tackifier inside the stacks, or cleaning and removal of ash and other materials. The fall zones may have berms to reduce the lateral extent of the dust cloud. Also, a hardened berm near the base of the stack could act as a backstop to prevent rock and debris spreading from the base of the stacks during demolition.
- TVA would develop a project-specific SWPPP as required under the General Permit for Stormwater Discharges Associated with Construction Activities (TDEC 2021a) prior to beginning demolition.
- To mitigate the potential for effects to public safety, TVA would restrict or close roads in the vicinity should blasting be used to demolish the stack. No barge or boat traffic would be allowed in the area during the stack blasting activities.
- TVA would work with the demolition contractor to create a detailed site-specific plan for any public road closures that would be distributed to affected parties, including emergency personnel.
- TVA would require the demolition contractor to develop and implement a blast plan to minimize vibration effects at CUF and in the vicinity. After obtaining site specific data provided by the blasting contractor, and if deemed necessary during development of the demolition plan, TVA would work with a documentation services company to prepare a vibration model simulating the effects of discharge of the explosives or vibrations due to the stack hitting the ground. If indicated by the results, imported fill, dirt binder, and geofabric could be used for mitigation of noise and vibration.
- During the construction planning process, TVA would determine mitigation measures to minimize potential effects to onsite power transmission equipment from vibrations caused by explosive demolition of the stacks. Use of such mitigation measures would address any power disruptions.
- Explosives would be managed under the direction of a licensed blaster, 24-hour security would be provided to monitor the explosives, and detailed security plans would be developed and provided to area emergency response agencies as part of measures that would be taken to mitigate potential effects on the safety of personnel and the public.
- If construction or operations have the potential to emit pollutants greater than acceptable thresholds in CUF's existing Title V permit, mitigation would include a request to modify the permit, which would be required for the prevention of significant deterioration of air quality.

Floodplains

- To minimize adverse effects on natural and beneficial floodplain values, the following mitigation measures would be implemented:
    - Transmission construction activities would adhere to the TVA subclass review criteria for transmission line location in floodplains;
    - CUF decommissioning and deconstruction debris would be disposed of outside 100-year floodplains;
    - The natural gas pipeline lateral would be installed through trenching or directional drilling, and any excess fill resulting from this would be disposed of outside 100-year floodplains;
    - For any access roads proposed within 100-year floodplains but not floodways, the roads would be constructed such that flood elevations would not increase more than 1.0 foot;
    - For any roads proposed within 100-year floodways, and to prevent an obstruction in the floodway, (1) any fill, gravel or other modifications in the floodway that extend above the pre-construction road grade would be removed after completion of the project; (2) this excess material would be spoiled outside of the published floodway; and (3) the area would be returned to its pre-construction condition;
    - Any switchyard(s) located in the floodplain would be located a minimum of one foot above the 100-year flood elevation at that location for a regular action, or a minimum of the 500-year flood elevation for a critical action, as well as be consistent with local floodplain regulations;
    - The flood-damageable components of the solar panels, as well as other flood-damageable structures and facilities sited in floodplains, would be located at least one foot above the 100-year flood elevation at that location and would otherwise be consistent with local floodplain regulations; and
    - In construction laydown areas, flood-damageable equipment or materials located within the 100-year floodplain would be relocated outside the floodplain during a flood.

2.3.2. Non-routine mitigation measures associated with Alternative A

TVA is considering multiple non-routine mitigation measures, such as the construction and operation of a distribution solar facility or lithium-ion battery, on the CUF Reservation to either offset a portion of energy usage for station service from facilities at the Cumberland Reservation directly or to plan for future conditions, which may necessitate the need for future mitigation efforts.

TVA is also looking into carbon capture and sequestration or storage (CCS) and is planning to explore the deep geologic formations that lie beneath or in close proximity to multiple TVA locations, including Cumberland. TVA has commissioned a study of existing geological data to ascertain the potential for underground carbon sequestration near the CUF Reservation. The preliminary results of that study show some potential but are inconclusive on storage volume available. TVA is planning to confirm the results of that study and further explore deep geology for suitability/capability of carbon storage. That further exploration will most likely require a classification test well to understand local suitability for sequestration at which time carbon capture with on-site storage could be evaluated. If these efforts do not yield acceptable storage reservoirs locally, then onsite use of CO_2 as a feedstock for a

utilization process or transportation would be explored. Utilization of CO_2 is not currently feasible at an appropriate scale to be evaluated for this specific project; however, TVA is hopeful that a chemical utilization process to combine captured CO_2 with other feedstocks to produce useful products (like sustainable aviation fuel, synthetic chemical feedstocks, plastics, and others) will emerge that could be reasonably demonstrated at scale. Pipeline routes for transport have not been identified at this time; however, the most promising geological location would appear to be in the Coastal Plains to the south based on a national assessment of geologic storage by the USGS (2013).

TVA has considered the USEPA's draft whitepaper on reducing GHG emissions from combustion turbines (USEPA 2022b) and anticipates that the efficiency, effectiveness, scalability, and economics of these systems will improve in the next several years, which will allow for more informed decisions in the future when adequate storage locations or pipelines are identified for both delivery of hydrogen and the storage or use of captured CO_2. TVA intends to monitor advancements in technology through its partnerships with national labs, universities, and industry groups to be ready to evaluate deployments of demonstrations if a captured CO_2 stream becomes available.

TVA has committed to ensuring that the design of the Alternative A CC plant would enable and accommodate potential future modifications for carbon capture and the combustion of hydrogen as a replacement or supplemental fuel for natural gas, as and when these technologies mature to scale. The proposed CC would be designed to be 5 percent hydrogen capable at commissioning by adding balance of plant (BOP)[5] equipment that includes areas for future hydrogen storage, appropriately sized piping, and a blending station during the original construction. TVA would also purchase a combustion turbine capable of burning at least 30 percent hydrogen, by volume, with modifications to the balance of plant once a hydrogen source is available. TVA would only consider burning hydrogen as a part of test burns or normal operations when it is commercially available at an acceptable chemical content that would reduce carbon emissions and be price-competitive in the market at that time.

TVA is considering incorporating environmentally beneficial features, such as pollinator habitat, at the CUF site in the future.

It is important to note that once a viable option for future mitigation projects is identified, TVA would conduct additional analyses to determine proposed pipeline routes, costs, storage requirements, or other needs with hydrogen fuel incorporation. TVA would analyze the site- specific impacts associated with any future mitigation that is planned as additional details become available. Additional equipment could be located in the area of the current coal plant after that area is closed and remediated.

Non-routine mitigation measures associated with cultural resources, specifically the historic Henry Hollister House, include adherence to the project specific MOA that has been executed for the Cumberland Retirement project. These mitigation measures include

- Installation of a Tennessee Historical Marker
    - TVA will submit a proposal for a historical marker through the Tennessee Historical Commission's (THC's) Historical Markers Program; work with THC

[5] The Balance of Plant (BoP) is a power engineering term referring to the various supporting and auxiliary components of a power plant.

staff regarding eligibility of the proposed marker for the program and regarding the marker's location and text; and install the marker, at TVA's expense, in an appropriate location, accessible by the public, near the Hollister House. The historical marker will present a brief narrative of the history and historic significance of the Hollister House.

- Vegetative Screening
  - TVA will plant trees to screen views to the new facilities from the Hollister House.
  - TVA will create the vegetative screening using various tree species, including native species, and including both deciduous and evergreen species.
  - TVA will plant the vegetative screening on the south and east sides of the Hollister House, on TVA property.
  - TVA will maintain the vegetative screening for so long as TVA owns and operates the new CC plant, so that it may provide the visual screen in perpetuity.
- Study of Graveyard Hill Cemetery
  - TVA will complete a search for documents related to the Graveyard Hill Cemetery and the persons who may be buried there.
  - The archival study will endeavor to include (but will not necessarily be limited to) the following sources: birth and death certificates, marriage certificates, deeds, census data, records of sales in the slave trade, and obituaries.
  - TVA will also complete a delineation of the cemetery using one or more remote sensing methods and shall attempt to identify the boundaries of the cemetery and anomalies that could correspond to graves.
  - TVA will prepare a report of the investigations and submit them to SHPO for review and comment and provide a final report that addresses any comments received from SHPO/THC.
- Updating the Hollister House NRHP Registration Form
  - TVA will update the Hollister House NRHP Registration Form, which was completed in 1987, with new information detailed in three historic architectural assessments performed between 2012 and 2022.
  - The new information will include details of the history of the property and the associated cemeteries (Brunson/Hollister Cemetery and Graveyard Hill Cemetery), additional historic photographs, and information on the property's current condition, and the inclusion of any additional resources that TVA and SHPO agree in consultation are contributing resources to the Hollister House.
  - TVA will provide the updated form to the THC for review, and upon approval, to the National Park Service.

2.3.3. Mitigation measures for the natural gas pipeline

TGP has identified numerous mitigation measures for the construction and operation of the 32-mile natural gas pipeline. These mitigation measures are summarized in the anticipated effects sections for various environmental resources in Chapter 3 of this EIS and described in more detail in the TGP Resource Reports. The mitigation measures include many of the standard practices to comply with environmental laws and regulations listed above for TVA

actions in Section 2.3.1. They also include mitigation measures specific to FERC authorization of natural gas facilities.

2.4. The Preferred Alternative

TVA completed an alternatives evaluation for the proposed retirement of CUF (Appendix B) and has identified Alternative A as its preferred alternative. Under the preferred alternative, TVA would retire and demolish the two coal units, construct a new natural gas-fueled CC plant at Cumberland with a generating capacity of approximately 1,450 MW, which would replace the generation lost as a result of retiring one CUF unit. This replacement aligns with the 2019 IRP near-term actions to evaluate engineering end-of-life dates for aging generation units to inform long-term planning and to enhance system flexibility to integrate renewables and distributed resources. This alternative is consistent with the need set forth in the 2019 IRP to establish new capacity in the TVA region, and increase reliability and flexibility, as well as meeting near-term TVA energy production goals. Financial and system analysis indicates that replacement with a CC plant is the best overall solution to provide low-cost, reliable, and cleaner energy to the TVA power system. TVA has also selected Alternative A as its preferred alternative because the proposed CC plant at CUF provides the flexibility needed to reliably integrate 10,000 MW of solar into the system by 2035 and enables the CUF coal-fired units to be retired on schedule. Further, the proposed CC plant could be built and made operational by 2026, as required to meet the project purpose and need and reduce economic, reliability and environmental risks.

In contrast, although Alternatives B and C would provide the necessary replacement power, these alternatives would require substantial transmission upgrades and lengthy timeframes for the transmission work such that they would not meet the need to provide replacement generation by the time the first CUF unit is retired in 2026. Moreover, Alternative C would not provide the firm, dispatchable generation needed to meet year-round generation.

TVA's primary analysis for GHG impacts is based on the use of "proxy emissions." As detailed in Section 3.7.2.6.2, although Alternatives A, B, and C are all generally within a similar range of SC-GHG savings when compared to the No Action Alternative, Alternative C would result in fewer GHG emissions and more SC-GHG emissions savings than Alternative A. As shown in the evaluation of alternatives in Appendix B, however, Alternative C costs approximately $1.8 billion more than Alternative A in project costs which includes capital, fuel, transmission, and production costs. After giving due weight to the supplemental GHG analysis that projected greater SC-GHG emissions savings for Alternative C than for Alternative A, TVA has determined that Alternative A is still the Preferred Alternative based on its ability to meet the purpose and need of providing firm, dispatchable power by 2026, and to significantly reduce carbon emissions as compared to the No Action Alternative.

CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter begins with a description of other actions that are considered in the cumulative analyses and the methodology for analyzing the environmental impacts of solar and storage facilities and of the transmission and electrical system components. It continues with the existing environmental conditions of the project area, as defined for each resource area, and the potential environmental effects that could result from implementing the No Action or Proposed Action Alternatives.

3.1. Identification of Other Actions

In addition to impacts of the action alternatives identified in Chapter 2, this analysis also considers the impacts of past, present, and reasonably foreseeable future actions (RFFAs) listed in Table 3.3-1. These other actions were identified within the overall 10-mile geographic area of analysis surrounding each action alternative as having the potential to, in aggregate, result in larger and potentially adverse effects to the resources of concern. Note that the RFFAs assessed here are based on project information that is publicly available online and does not include private developments or projects that have not yet been announced. Potential cumulative effects for resources in which adverse effects from the proposed project are anticipated are discussed in each resource section.

Table 3.1-1. Summary of other past, present, or reasonably foreseeable future actions within a 10-mile radius of the Action Alternatives

Action	Description	Project Type
CUF Reservation		
Borrow site and access roads	Described in Cumberland Fossil Plant Borrow Areas and Access Road EA (TVA 2017b).	Past
Wastewater treatment facilities	Described in Cumberland Fossil Plant Wastewater Treatment Facility EA (TVA 2019c).	Past
CCR Management Activities, including new landfill, groundwater monitoring wells, haul roads, process flow management facilities, gypsum storage areas.	Described in Cumberland Fossil Plant Coal Combustion Residuals Management Operations EIS (TVA 2018a).	RFFA
Daejin Advanced Materials USA	A plastic injection molding company for the automotive industry, announced plans to establish operations in Cumberland City, Tennessee. Plans for the project include creating 83 new jobs and investing $10 million in the facility which will support electric vehicle battery supply chain operations (Clarksville Now 2022).	RFFA
Alternative A Natural Gas Pipeline		
Dickson Terminal Project	A proposed mid-sized petroleum storage and distribution terminal in an unincorporated portion of Dickson County near Interstate 40 zoned for heavy industrial use (Gadd 2022).	Past/Present

Action	Description	Project Type
Dickson County Municipal Airport Lighting Upgrade	The Dickson County Municipal Airport is upgrading its lighting system on the runway and tarmacs. The lighting plan includes LED lights for runway and taxiway lights, landing aids and navigational lighting. The project was scheduled for completion by September 2022 (Lurie 2021).	Past/Present
Canterbury Industrial Site Preparation	Clearing, rough grading, and access road work to prepare the 54-acre Canterbury Site in Dickson County, TN for industrial development. Target industries for recruitment to the site include automotive suppliers, advanced manufacturers, food/beverage manufacturers, and medical equipment manufacturers. TVA is assisting with the site preparation, which is currently underway (Dickson County Economic Development Alliance 2022).	Past/Present
Hayes Fork Wetland Mitigation Bank	Development of a wetland mitigation bank near Bumpus Mills in Stewart County, Tennessee, including restoration of 5,550 linear feet on Hayes Fork Creek and two unnamed tributaries and 19 acres of riparian. The mitigation bank will provide additional compensatory wetland mitigation for permitted impacts to streams and wetlands within the primary geographic service area of the Lower Cumberland (HUC-8:05130205), Harpeth River (HUC-8:05130204), and Lower Cumberland-Sycamore (HUC-8:05130202) watersheds (Westervelt Ecological Services 2022).	Past/Present
Magnum Manufacturing Expansion	Magnum manufactures metal stamping and produces raw metal seat frames and doors for the automotive sector. In 2017, Magnum announced plans to expand its facilities in Erin and Houston counties, TN, with plans to create approximately 50 jobs in Houston County by 2022 (Area Development 2017).	Past
Cumberland River Compact In-Lieu Fee Program	The Cumberland River Compact (Compact) established the Compensatory Mitigation program in 2018 with the goal of creating a mechanism and source of revenue for stream restoration projects. The program goal is to restore approximately 3,525 linear feet of streams and allows the Compact to generate and sell credits that are then used to support various stream restoration, establishment, enhancement, and preservation projects as compensation for unavoidable impacts and loss of ecological functions affected by permitted activities. Credits are currently available for purchase (Cumberland River Compact 2022).	Present and RFFA
Alternative B: JCT Reservation		
JCT Coal Plant Deconstruction	TVA retired all ten units of the JCT coal-fired plant gradually beginning in 2012, with the final four units retired on Dec. 31, 2017. All 10 Units have been demolished (TVA 2018c).	Past

Action	Description	Project Type
JCT Aeroderivative CTs	TVA is adding 10 natural gas-fired Aero CTs at the Johnsonville Reservation. Once constructed, the Aero CTs would generate approximately 550 MW with commercial operation anticipated no later than December 31, 2024. TVA's Johnsonville Reservation currently houses 20 simple-cycle CT units within the JCT plant. The existing JCT Units 1-16 will be retired with their combined generation being replaced by TVA's Paradise and Colbert facilities (TVA 2022f).	RFFA
Alternative C: Solar and Storage Facilities		
Expansion of solar facilities under the 2019 IRP	TVA is proposing to add 10,000 MW of solar by 2035 throughout the TVA power service area. While projects have not yet been identified, they would require individual NEPA reviews once identified as a potential TVA project or under a power purchase agreement (TVA 2019a).	RFFA

3.2. Methodology for Assessing Impacts of Solar and Storage Facilities

As noted in the 2019 IRP, TVA currently operates a few small solar photovoltaic (PV) installations and purchases power from numerous small and large (utility scale) PV facilities. In response to the IRP, as well as customer driven demand, TVA has assessed the potential environmental effects of solar PV facilities in multiple EAs conducted over the past several years and in the North Alabama Utility-scale Solar Facility EIS completed in May 2022. Since the exact project locations for solar and/or storage projects described under Alternative C are not known at this time, TVA has compiled a list of typical effects associated with the construction and operation of PV facilities within the TVA region (Table 3.2-1). While the number of sites is dependent upon the generating capacity, TVA has assumed that generating 3,000 MW of solar would require approximately thirty 100 MW sites. This list was compiled by reviewing the EAs and the EIS for community- to utility-scale PV projects issued from 2014 through 2022. A total of 31 projects were included in the review.

Table 3.2-1. Typical Effects of Solar Facility Construction Activities Determined from a Review of Project Planning Documents of 31 Solar Facility Projects, 2014-2022

Land Use Effects	
Land Requirements (Acres of Solar Installation within the Site)	Average of 7.3 Acres per MW[1] Range: 2–9.6 acres per MW
Solar Facility Effects	
Floodplain Fill (Acres) per MW	Average of 0.02 acre per MW Range: 0–1.8 acres per MW
Prime Farmland Converted	81% of solar projects resulted in prime farmland conversion.
Forest Cleared (Acres)	Average of 64 acres Range: 0–434 acres

	Average of 1.2 acres per MW Range: 0–15 acres per MW
Parks and Public Lands	7% of solar projects affected parks and public lands
Historic Properties	3% of Solar Projects affected Historic Properties
Water Resource Effects	
Wetland Area Affected	Average of 0.14 acres per MW Range: 0–0.73 acres per MW
	Average of 0.003 acres per MW Range: 0–0.1 acres per MW
Forested Wetland Area Cleared	Average of 0.34 acres Range: 0–4.26 acres
	Average of 0.01 acres per MW Range: 0–0.1 acres per MW
Stream Effects	Average of 367 linear feet (LF) Range: 0–6,900 linear feet
	Average of 8.7 LF per MW Range: 0–41 acres per MW
Biological Effects	
Endangered and Threatened Species	48% of solar projects affected federally listed endangered or threatened species or species proposed or candidates for listing
Migratory Bird Effects	9% of solar projects resulted in effects to migratory birds of conservation concern
Bald and Golden Eagle Effects	None
Visual Effects	99% of solar projects resulted in visual effects
Environmental Justice	May vary based on location, but typically, none with amplified adverse effects

[1]All MW are reported in Alternating Current (AC).

BESS is a new resource and technology for TVA; therefore, TVA does not have experience of multiple projects to assess typical effects, as it does for solar facilities. For the purposes of analyzing Alternative C in this EIS, TVA uses the anticipated effects associated with a BESS pilot study project that is capable of generating 20 megavolt amperes (MVA) with a storage capacity of 40 MWh in Vonore, Monroe County, Tennessee (TVA 2022d). Approximately 10 to 15 acres of land would be required for the BESS pilot project, including an associated new 161-kV substation consisting of a transformer, breakers, power quality meters, a Supervisory Control and Data Acquisition Remote Terminal Unit (SCADA RTU), relays, alarms, a capacitor-controlled voltage transformer (CCVTs), switch house, and other equipment. The battery site will be approximately four acres at completion. Construction would consist of grading the site and installing a foundation to place the battery containers, inverters, electrical and communications connections for the BESS and heating, ventilation, and air conditioning (HVAC) system monitoring and control. The battery containers are modular steel construction similar to intermodal shipping containers in which the modular

lithium-ion battery cells are mounted on racks and connected by cabling. The battery containers are equipped with air conditioning and fire protection systems, auxiliary distribution board, and lighting. There are 12, 40 ft. battery containers, 12 (2.5 MVA) transformers, 24 inverter cabinets and a 13.8-kV switchgear for the Vonore Project. A new communication cabinet and a 1.5-MVA transformer would also be needed. Additionally, a loop connection point would be installed on the existing Loudon-Tellico Reservoir Development Agency (TRDA) 69-kV TL. Direct transfer trip and transfer trip work would occur at the Vonore, TN 161-kV Substation.

3.3. Analyses Methodology for Transmission and Electrical System Components

Because the exact locations are not yet known for the transmission components for Alternatives B and C, the analyses of environmental consequences for the 40-mile-long transmission line proposed in Alternative B and the transmission upgrades and lines anticipated to support solar and storage facilities in Alternative C use typical effects from construction activities related to transmission projects, as compiled in the 2019 IRP EIS. A total of 298 projects were included in the review (Table 3.3-1).

Table 3.3-1. Typical Effects of Transmission System Construction Activities Determined from a Review of Project Planning Documents of 298 Transmission Construction Projects*, 2005-2018

Use Effects	Transmission Lines	Substations and Switching Stations
Land Use Effects		
Land requirements	Average of 13.1 acres/line mile, range 3.5 – 39	Average of 10.8 acres, range 1 – 73 median for 500 kV: 49.5 acres Median for <500 kV: 5.5 acres
Floodplain fill	De minimis	Average of 0.1 acres, range 0 – 4 5% affected floodplains
Prime farmland converted	None	Average of 6.9 acres, range 0 – 29.1 64% affected prime farmland
Forest cleared	Average of 5.5 acres/line mile for new lines, range 0 – 30.5	Average of 4.5 acres, range 0 – 50 29% cleared forest
Parks and Public Lands	40 (16%) of 249 projects affected parks and public lands	
Historic Properties	41 (14%) of 288 projects affected historic properties	
Water Resource Effects		
Wetland area affected	Average of 0.9 acres/line mile for new line, range 0 – 22.2 55% affected wetlands Average of 0.9 acres/line mile of existing line, range 0 – 18.3 52% affected wetlands	Average of 0.1 acres, range 0 – 1.8 15% affected wetlands
Forested Wetland Area Cleared	Average of 0.9 acres/line mile of new line, range 0 – 18.3 52% affected wetlands	Undetermined

Use Effects	Transmission Lines	Substations and Switching Stations
	Average of 0.02 acres/line mile of existing line, range 0 – 0.5 17% affected forest wetlands	
Stream crossings	Average of 2.9 per mile of new line, range 0 – 50, 76% crossed streams	Undetermined
	Average of 1.5 per mile of existing line, range 0 – 5.6, 64% crossed streams	
Forested stream crossings	Average of 1.0 per mile of new line, range 0 – 17.6, 48% crossed forested streams	Undetermined
	Average of 0.1 per mile of existing line, range 0 – 2.5, 8% crossed forested streams	
Biological Effects		
Endangered and Threatened species	32 (11%) of 256 projects affected federally listed endangered or threatened species, or species proposed or candidates for listing 63 (22%) of 290 projects affected state-listed endangered, threatened, or special concern species	

*Note: Because some project planning documents did not contain all of the environmental data, the sample sizes for the various categories differ.

The above information was compiled to provide an estimate of the potential effects associated with the construction of transmission and electrical system components for Alternatives B and C. Since exact site locations for solar and storage facilities associated with Alternative C and for the 40-mile transmission line associated with Alternative B are not known at this time, additional site-specific tiered NEPA analysis would need to be completed as projects are identified and their scope is further defined.

3.4. Environmental Justice

Potentially affected Environmental Justice (EJ) populations, including minority, low-income, and limited English proficiency (LEP) populations, are identified in this section using the U.S. Census Bureau (USCB) 2010 decennial census (2010 Census), USCB 2020 decennial census (2020 Census), and the 2015-2019 American Community Survey (ACS) 5-year estimates (2019 ACS), depending on availability of data. State-level and, for some characteristics, county-level USCB data are included for analysis and comparison purposes. Decennial census and ACS data were obtained utilizing ESRI Location Data (ESRI 2022) and USCB Explore Census Data (USCB 2021a). Where appropriate, additional data from USCB are employed, as cited herein. EJ populations were determined through a comparison of the most recent, available USCB data to threshold criteria selected based on guidance from the CEQ, as defined below. USEPA's EJScreen: Environmental Justice Screening and Mapping Tool (Version 2.0; hereafter, EJScreen) was also reviewed and compared with the compiled USCB census data.

Potential effects to identified EJ populations are then analyzed in this section and subsequent sections in Chapter 3 where project effects are anticipated, in accordance with EO 12898, to identify and address disproportionately high and adverse human health or

environmental effects of each alternative on minority populations and low-income populations. While not subject to this EO, TVA routinely considers EJ during its NEPA review processes.

The CEQ guidance for applying EO 12898 under NEPA directs identification of minority populations when the total minority population of the affected area exceeds 50 percent, or the minority population percentage of the study area is meaningfully greater than the minority population percentage in the general population or through another appropriate unit of geographic analysis (CEQ 1997). CEQ defines minority populations as people who identify themselves as Asian or Pacific Islander, American Indian or Alaskan Native, Black (not of Hispanic origin), or Hispanic. Those indicating two or more races are also considered minorities due to necessarily including one of these minorities.

The CEQ guidance specifies that low-income populations are to be identified using the annual statistical poverty threshold from the USCB Current Population Reports Series P-60 on Income and Poverty. The current (2020) USCB-provided poverty threshold for individuals under age 65 is $13,465, and the official poverty rate for the US as a whole is currently 11.8 percent (USCB 2020). Study area income and poverty rates are compared with the county and/or state data using the 2019 USCB Small Area Income and Poverty Estimates (SAIPE) (USCB 2019), as recommended by USCB (USCB 2020). For purposes of this analysis, low-income populations were defined as those with poverty rates that are less than two times the poverty level (i.e., those with poverty ratios defined in the 2019 ACS as 1.99 or lower). More encompassing than the base poverty level, this low-income threshold, also used by USEPA in their delineation of low-income populations, is an appropriate measure for EJ consideration because current poverty thresholds are often too low to adequately capture the populations adversely affected by low-income levels, especially in high-cost areas (USEPA 2017). According to USEPA, the effects of income on baseline health and other aspects of susceptibility are not limited to those below the poverty thresholds. For example, populations having an income level from one to two times the poverty level also have worse health overall than those with higher incomes (Centers for Disease Control and Prevention 2011).

For each study area as defined below, the census block groups or counties with minority percentages that were 10 percentage points above the study area average or higher in the 2019 ACS are identified by TVA as the areas where the chance for amplified environmental and human health effects to minority populations may be greatest (i.e., the qualifying minority EJ populations). The census block groups or counties with poverty ratios that were 20 percentage points above the study area average and/or above 50 percent based on the 2019 ACS are identified as the areas where the chance for amplified environmental and human health effects to low-income populations may be greatest (i.e., the qualifying low-income EJ populations). These approaches to defining minority and low-income populations were taken in the TVA analysis due to the socioeconomic aspects of the study areas across all alternatives, where, in comparison with the state, the populations were generally more aged and had fewer high school graduates or higher, higher unemployment rates, and lower per capita income, as detailed in Section 3.16. Therefore, the TVA approach allowed for identification of the most vulnerable portions of the mostly rural, depopulating study areas, where the chance for amplified environmental and human health effects to human populations may be greatest.

According to CEQ guidance, minority and low-income populations may be groups of people living in geographic proximity or scattered groups or individuals sharing common conditions.

As such, CEQ directs identification of groups demonstrating differential patterns of consumption of natural resources among minority and low-income populations. Specialized groups are identified, where commensurate with anticipated effects, in relation to particular resource areas; these are presented in the EJ Considerations subsections in Chapter 3, where relevant.

LEP populations are also assessed in this section, pursuant to Title VI of the Civil Rights Act of 1964 (42 USC § 2000d et seq.), U.S. Department of Justice (DOJ) Guidance to Federal Financial Assistance Recipients Regarding Title VI Prohibition Against National Origin Discrimination Affecting Limited English Proficient Persons [DOJ LEP guidance; *Federal Register* 67(117):41455-41472, June 18, 2002], and EO 13166 [*Federal Register* 65(159):50121-50122, August 16, 2000]. Based on DOJ LEP guidance, LEP language groups that constitute five percent or 1,000 individuals, whichever is less, should be offered translated project materials, where relevant. Eligible LEP language groups are defined herein as those whose members self-report speaking English less than well, based on the 2019 ACS, and are identified at the census block group level. As Alternative C, as described below, is analyzed at the county level, LEP populations will be defined in later, tiered NEPA analyses.

In addition to desktop sources listed above, TVA used their internal Customer Analytics group to identify specific EJ-qualifying residences within three miles of the plant locations (CUF, JCT, and Gleason). TVA contacted the Highland Rim Economic Corporation, local plant personnel, and local government officials to verify that known low-income, LEP, or minority communities located near the CUF, JCT and Gleason reservations were included in this desktop review. TVA also contacted the local school board to provide information regarding the project and requested input regarding EJ-qualifying communities. No specific EJ communities, vulnerable EJ areas, or EJ concerns were identified beyond the desktop analysis presented in this section.

TVA also considered EJ-qualifying census block groups identified in the TGP EJ analysis for the natural gas pipeline associated with Alternative A. TGP's analysis used a different "meaningfully greater" threshold for defining EJ populations. Following FERC guidance, TGP used the following criteria to identify EJ populations (TGP 2022e):

> …communities where the percentage of minorities within a given census tract/block group exceeds 50 percent, or the minority population in the census tract/block group affected is 10 percent higher than the minority population in the county (meaningfully greater), [is defined as] an environmental justice community …
>
> …if the percent low-income population in the identified census tract/block group is greater than or equal to that of the county, then an environmental justice community is present.

Because the TGP EJ population criteria differed from the TVA criteria and due to the overlap of the CUF and natural gas pipeline lateral EJ study areas, these additional EJ-qualifying census block groups were also incorporated into TVA's EJ analysis in this EIS in relation to CUF retirement and D4 activities. In relation to the pipeline activities, TGP has conducted outreach among and will continue to engage "community leaders and groups within the environmental justice communities (minority, low-income populations, and non-English speaking communities) that may be impacted by the [pipeline], including community

leaders, civic organizations, churches, and non-profit community organizations that provide assistance to environmental justice communities" (TGP 2022e).

Where populations were determined to meet the criteria regarding minority, low-income, and/or LEP status and, therefore, considered qualifying EJ populations, additional USCB data, USEPA data, historical information, and relevant details from other sources were obtained to better understand the socioeconomic and sociocultural aspects of these populations and more effectively evaluate for amplified effects on EJ populations. The additional USCB data obtained included other relevant demographic factors, as well as information regarding the rural or urban status of the area. USCB criteria define an urbanized area as having a population of 50,000 or more and an urban cluster as having a population between 2,500 and less than 50,000; all areas outside of urbanized areas and urban clusters are considered rural. USEPA's EJScreen tool was used to consider 12 different environmental indicators in EJ-qualifying areas in comparison with the state. The environmental indicators consist of those relevant to air quality and proximity to traffic, toxins, underground storage tanks (USTs), hazardous waste facilities, Superfund sites, and wastewater discharges.

For the CUF, Gleason, and Johnsonville Reservations, the area from which potentially affected EJ populations are identified is a 10-mile radius of the given project area. This area was selected to (1) understand the larger demographic context, including non-EJ areas, to allow for analysis of amplified effects on EJ populations with attention to their different characteristics, (2) evaluate EJ effects based on the full extent of project effects on other resource areas (such as air quality, transportation, water resources, etc.), and (3) analyze cumulative effects on EJ populations. The 10-mile radius was determined to encompass the largest area of potential impact for any of the resource areas analyzed within this EIS.

For the pipeline corridor associated with Alternative A, the area from which potentially affected EJ populations are identified is a one-mile radius of the project area. A one-mile radius around the corridor encompasses the largest area of potential impact from the pipeline in relation to the resource areas analyzed within this EIS and, therefore, provides an appropriate review of potentially affected EJ populations commensurate with transportation, noise, air, visual, and other effects associated with the pipeline. This radius is sufficiently broad considering the likely concentration of construction emissions, noise, and traffic impacts proximal to the pipeline construction and consistent with FERC regulations (18 CFR § 380.12 Environmental reports for Natural Gas Act applications). This radius is conservative for pipeline safety, as it is much greater than the 220-yard (0.125 mile) area of consideration to define human uses (i.e., class locations and high consequence areas) used by USDOT Pipeline and Hazardous Materials Safety Administration (PHMSA). This is also conservative relative to the potential impact radius (PIR) also utilized by PHMSA in the unlikely event of pipeline failure. The PIR is used to analyze the area within which the potential failure of a pipeline could have significant impact on people or property, in accordance with 49 CFR § 192.903. For a natural gas pipeline of this size and pressure, a PIR of less than 500 feet was calculated. The one-mile radius also factors in the area utilized in the analysis prepared for the pipeline as part of the FERC pre-filing process, which included the census block groups that either cross the pipeline centerline or are within one mile of proposed aboveground facilities. The conservative one-mile analysis radius in this document would allow for future aboveground facilities anywhere along the length of the pipeline. The radius also aligns with the plan to locate the pipeline generally parallel and adjacent to existing electric transmission lines owned and operated by TVA within a cleared, 50-foot corridor, which would help reduce effects.

The CUF, Gleason, and Johnsonville Reservation and pipeline corridor EJ study areas are defined by the census block groups they overlap (Figure 3.4-1). The census block groups are given in tables as 2019 ACS Census Tract number and Block Group number (e.g., CT 1106 BG 2) overlap. When counties are overlapped by less than two percent of the overall study area, the associated census block groups are not included in the analysis to avoid skewing results. The EJ study area for Alternative C is defined by the counties within the Middle Tennessee region of the TVA PSA (Figure 3.4-2), and county-level data were used for this analysis.

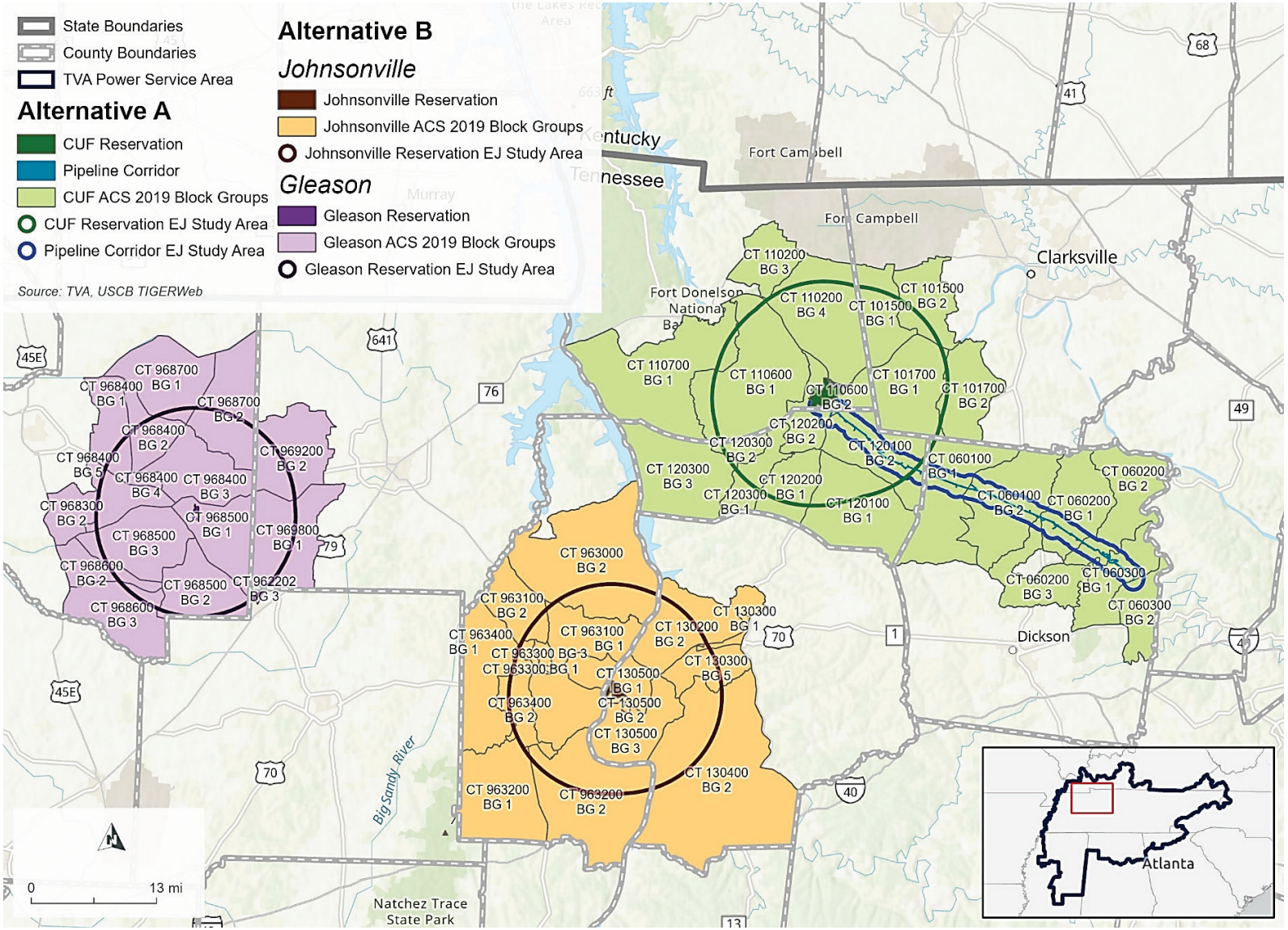

Figure 3.4-1. CUF Reservation and Alternative A and B Environmental Justice Study Areas

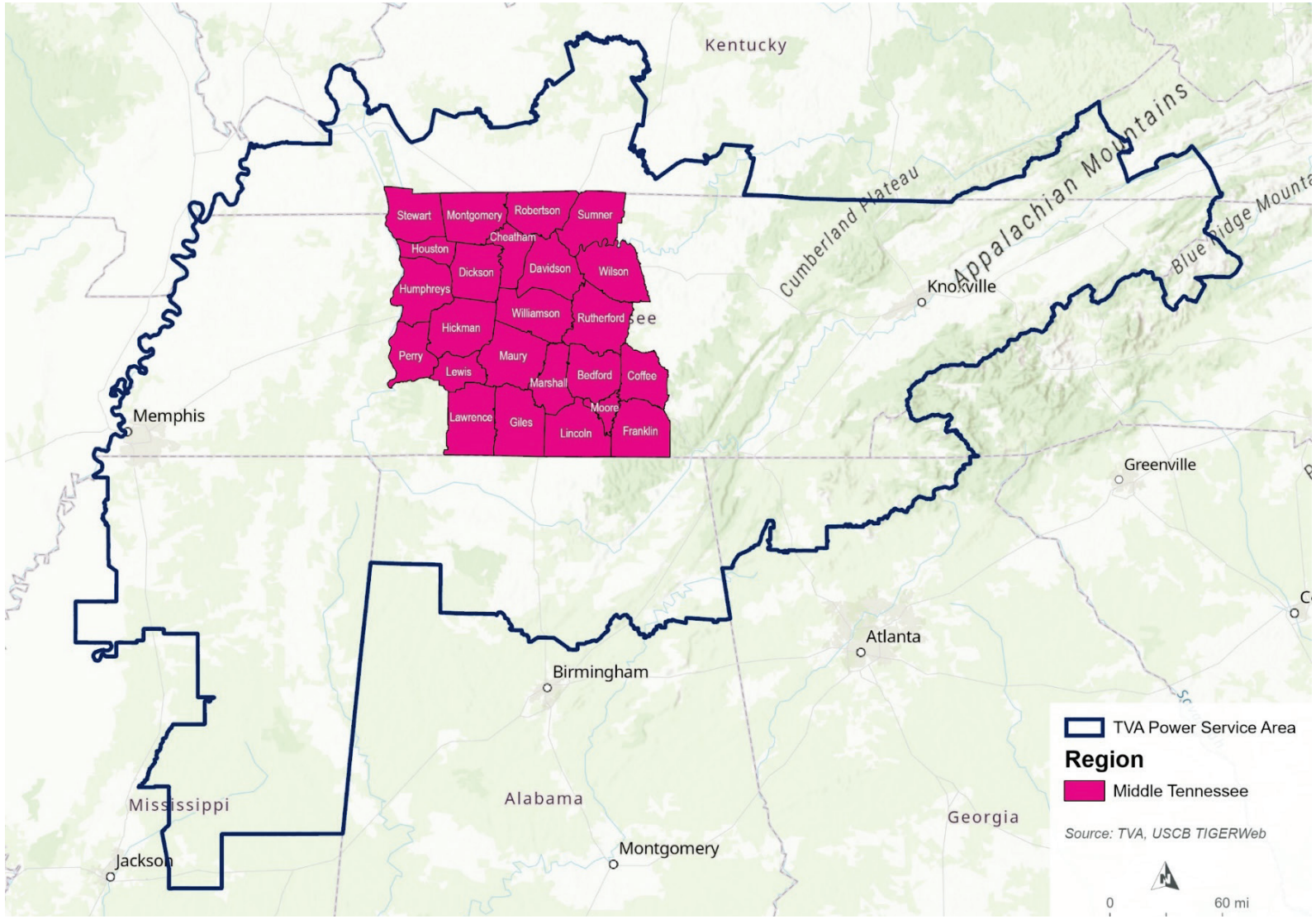

Figure 3.4-2. Alternative C Environmental Justice and Socioeconomic Study Area

3.4.1. Affected Environment

The EJ study areas associated with each alternative, as defined below, have recreational areas that support subsistence activities, such as fishing and hunting (see Section 3.9 for more detail on these specific resources). These recreational areas are utilized by diverse populations, including EJ populations, and are specifically considered in relation to EJ populations in relevant EJ Consideration subsections throughout Chapter 3. As this NEPA analysis tiers from the TVA IRP EIS (TVA 2019b), this EJ analysis likewise tiers from and incorporates the human context information presented in the IRP EIS. Refer to the IRP EIS for more details on the tribal populations and the sociocultural characteristics of the TVA PSA and the subregions within it.

The EPA's EJScreen tool indicates that the EJ study areas described below are not in areas with high concentrations of EJ populations, and those that are present are primarily low-income populations. Minority populations comprise relatively small percentages of the study areas.

The review of the affected environment for the CUF Reservation and the natural gas pipeline corridor draws upon the results from the EJ analysis in the Resource Reports submitted by TGP to FERC for the natural gas pipeline. As explained above, because the TVA and TGP analyses used different criteria for identifying minority and low-income populations, there were slightly different results. The TGP analysis identified several census block groups qualifying as EJ within the CUF Reservation and the natural gas pipeline EJ study areas that were not identified in the initial TVA analysis. Those EJ census block groups have now been included in this EJ analysis, wherein they are specifically discussed in Section 3.4.1.2.1.3.

3.4.1.1. CUF Reservation

The 10-mile radius surrounding the CUF Reservation, called the CUF Reservation EJ study area, includes all or portions of 16 census block groups (Figure 3.4-1). These block groups encompass portions of Stewart County, where the CUF Reservation falls within CT 1106 BG 2, and Houston and Montgomery counties, Tennessee. The CUF Reservation EJ study area is part of the overall study areas for all alternatives. This study area also encompasses the transmission line corridors associated with Alternative A.

3.4.1.1.1. Minority Populations

No census block groups within the CUF Reservation EJ study area were identified as qualifying minority EJ populations (Table 3.4-1). At the county level, a greater proportion of the populations of Stewart County, where the CUF Reservation is located, and all but one other affected county were self-identified as non-minority than across the associated state, based on the 2019 ACS. Correspondingly, the minority populations in these counties were generally smaller proportionally than statewide. The exception to this was Montgomery County, where there were higher percentages of all minority populations than the state.

At the census block group level, based on the 2019 ACS, in the vicinity of the CUF Reservation, 8.5 percent of people identified as minorities, a lower proportion than across the study area and the state. While the overall study area had a lower minority percentage than the state, six of the 16 census block groups within the CUF Reservation EJ study area had higher percentages of minorities in comparison with the overall study area percentage.[6] However, no census block groups in the study area had minority percentages that are 10 percentage points or more above the study area average of 8.8 percent.

[6] Throughout Section 3.4, overall study area percentages, also referred to as study area averages, were obtained by getting a simple average of each of the associated census block groups.

Table 3.4-1. Minority Percentages and Ethnicities in the CUF Reservation EJ Study Area

Geography	% Minority	% White[1]	% Black / African American	% Am. Indian / Alaska Native	% Asian	% Native Hawaiian / Pacific Islander	% Some Other Race	Two or More Races	% Hispanic / Latino[2]
Study Area	8.8	91.2	3.1	0.5	0.5	0.0	0.6	4.0	3.0
CUF Reservation	8.5	91.5	2.9	0.3	0.2	0.0	2.0	3.0	2.4
Tennessee	*20.4*	*79.6*	*17.9*	*0.9*	*2.2*	*0.1*	*1.6*	*2.0*	*5.4*
Stewart County	*8.2*	*91.8*	*0.9*	*0.2*	*0.7*	*0.4*	*0.0*	*2.9*	*3.0*
CT 1106 BG 2 (CUF)	8.5	91.5	2.9	0.3	0.2	0.0	2.0	3.0	2.4
CT 1102 BG 3	15.8	84.2	3.8	0.0	1.9	0.0	1.5	8.5	1.8
CT 1102 BG 4	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5
CT 1106 BG 1	8.1	91.9	0.0	0.8	0.0	0.0	2.8	4.5	4.7
CT 1107 BG 1	13.4	86.6	0.0	0.6	1.9	0.0	0.2	10.8	4.6
Houston County	*8.0*	*92.0*	*5.4*	*0.7*	*0.2*	*0.2*	*0.0*	*1.1*	*0.4*
CT 1201 BG 1	3.8	96.2	0.0	3.8	0.0	0.0	0.0	0.0	2.5
CT 1201 BG 2	10.9	89.1	7.6	0.0	0.0	0.8	0.0	2.4	0.0
CT 1202 BG 1	13.5	86.5	11.8	0.0	0.0	0.0	0.0	1.7	0.0
CT 1202 BG 2	11.3	88.7	11.3	0.0	0.0	0.0	0.0	0.0	0.0
CT 1203 BG 1	1.7	98.3	0.7	0.6	0.0	0.0	0.0	0.4	0.0
CT 1203 BG 2	3.1	96.9	0.5	0.2	1.1	0.0	0.0	1.3	0.0
CT 1203 BG 3	0.9	99.1	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Montgomery County	*36.7*	*63.3*	*19.3*	*0.5*	*2.1*	*0.4*	*0.4*	*4.0*	*10.0*
CT 1015 BG 1	3.7	96.3	1.1	0.0	0.0	0.0	0.0	2.6	9.4
CT 1015 BG 2	16.7	83.3	5.8	0.9	0.8	0.0	1.3	7.9	7.8
CT 1017 BG 1	2.7	97.3	1.5	0.4	0.3	0.4	0.0	0.0	6.2
CT 1017 BG 2	7.7	92.3	0.0	0.0	0.0	0.0	0.0	7.7	3.7

Source: 2019 ACS
[1] Race percentages are provided for those reporting a particular race alone or in combination.
[2] This group is calculated separately from the other ethnicities and may include overlap from the other categories, as the USCB does not consider Hispanic or Latino a “race.”
Note: Emboldened census block groups represent identified EJ populations as compared with the overall study area percentage.

While no minority EJ populations were identified in this analysis for the proposed action, Figure 3.4-4 shows the location of the EJ-qualifying minority census block group identified in the TGP EJ analysis (TGP 2022e) for the natural gas pipeline lateral, which also occur in the CUF Reservation EJ study area. These are discussed in Section 3.4.1.2.1.3.

3.4.1.1.2. Low-Income Populations

The census block groups emboldened in Table 3.4-2 represent areas with qualifying low-income EJ populations. Based on the 2019 SAIPE, a smaller proportion of the population of most affected counties, including Stewart County, was living in poverty when compared with the state as a whole. In Houston County, the proportion of the population living in poverty was higher than across Tennessee.

At the census block group level, based on the 2019 ACS, the immediate CUF Reservation vicinity and the CUF Reservation EJ study area as a whole had higher poverty ratios than the state. Eight of the 16 census block groups within the CUF Reservation EJ study area had higher percentages of people living in poverty than across the study area. Two census block groups had poverty ratios that were 20 percentage points or more above the study area average of 37.4 percent and/or were at or above 50 percent (Figure 3.4-3). These census block groups, emboldened in Table 3.4-2, are defined as the areas where the chance for amplified environmental and human health effects may be the greatest.

Table 3.4-2. Poverty Rates for the CUF Reservation EJ Study Area

Geography	2019 SAIPE Poverty %*	2019 ACS Poverty %, Households	2019 ACS Poverty Ratio, Two Times US Threshold **
Study Area			37.4
CUF Reservation			38.9
Tennessee	*13.8*	*13.2*	*34.9*
Stewart County	*12.9*		
CT 1106 BG 2 (CUF)		13.9	38.9
CT 1102 BG 3		16.0	30.9
CT 1102 BG 4		15.5	42.2
CT 1106 BG 1		10.5	**52.8**
CT 1107 BG 1		13.1	26.8
Houston County	*17.8*		
CT 1201 BG 1		12.2	28.9
CT 1201 BG 2		15.7	35.5
CT 1202 BG 1		20.3	45.3
CT 1202 BG 2		13.5	45.6
CT 1203 BG 1		25.9	45.6
CT 1203 BG 2		20.5	47.9
CT 1203 BG 3		33.6	**62.4**
Montgomery County	*12.0*		
CT 1015 BG 1		3.1	20.4
CT 1015 BG 2		1.4	12.9
CT 1017 BG 1		6.6	27.7
CT 1017 BG 2		22.3	32.9

*For the respective county in which the block group is located
**Calculated based on percent of population with a ratio of income to poverty threshold ≤1.99
Source: 2019 SAIPE, 2019 ACS
Note: Emboldened census block groups represent identified EJ populations as compared with the overall study area percentage.

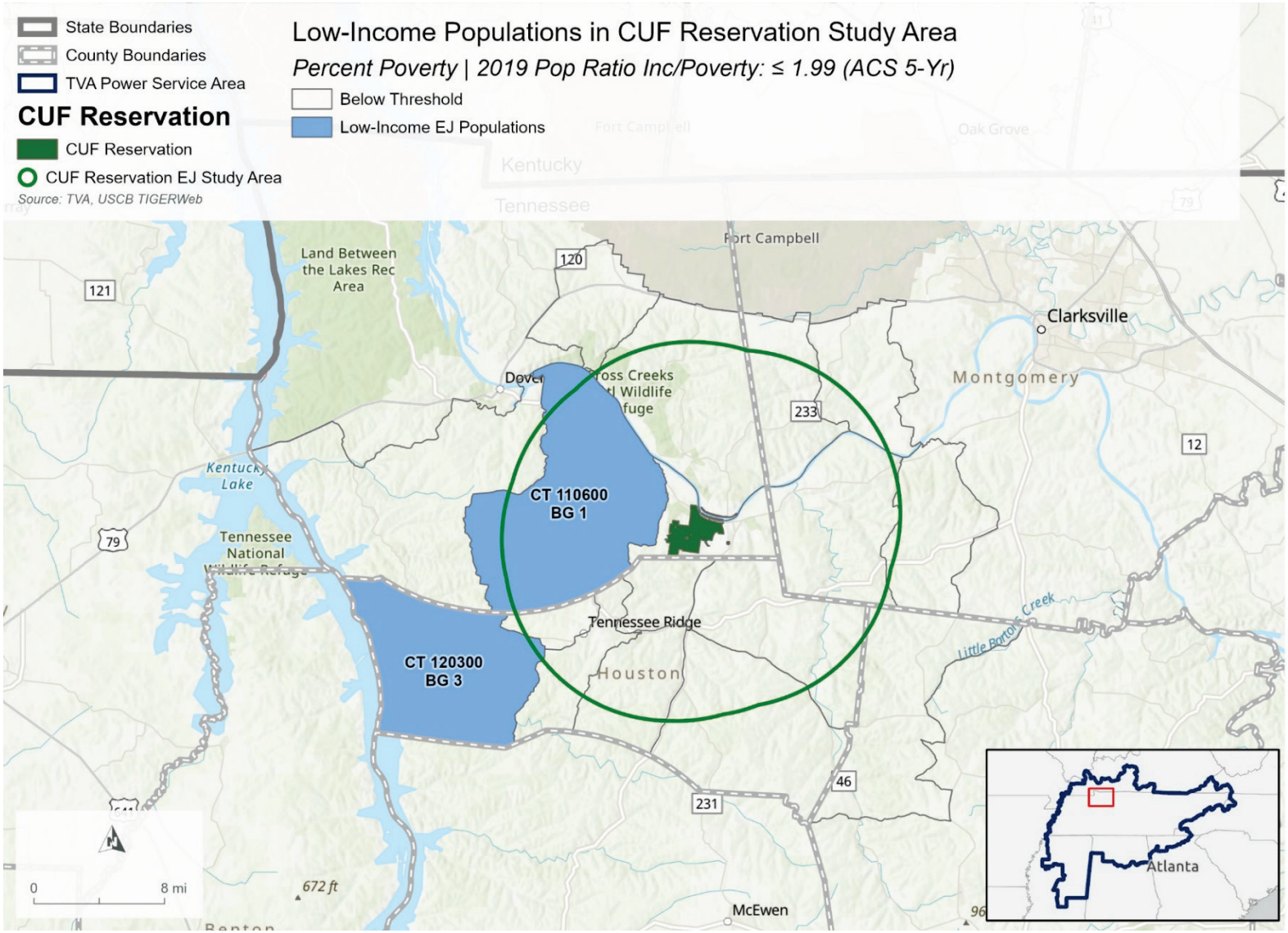

Figure 3.4-3. Low-Income Populations in CUF Reservation Environmental Justice Study Area

3.4.1.1.3. Qualifying Environmental Justice Populations

Additional data detail for the qualifying EJ populations, Stewart County CT 1106 BG 1 and Houston County CT 1203 BG 3, is provided in Table 3.4-3, along with comparison data for the state and respective county. Table 3.4-6 provides additional detail for six additional census block groups that were identified as EJ-qualifying populations, including three low-income and three minority EJ-qualifying census block groups, under the separate analysis prepared for the pipeline as part of the FERC pre-filing process described in Section 2.1.3.3.

While many factors are similar to the associated county for these EJ-qualifying low-income census block groups, Houston County CT 1203 BG 3 had a lower percentage of minorities, higher population growth rate, higher median age and more people over age 65, higher percentage of renter-occupied housing units, lower percentage of people in the workforce, and higher per capita income in comparison with Houston County. Stewart County CT 1106 BG 1 had a lower (negative) population growth rate, higher median age, lower percentage of renter-occupied housing units, and higher unemployment rate in comparison with Stewart County.

Stewart County was historically important due to its proximity to the Cumberland and Tennessee rivers, both of which were impounded to create Lake Barkley and Kentucky Reservoir, respectively (Barrett and Karpynec 2008; Hunter et al. 2022). Substantive population decreases occurred from the 1940s through 1960s due to development of Fort Campbell and Kentucky Reservoir, the latter of which required acquisition and flooding of agricultural lands. Agricultural activity and timber and iron ore industries were traditionally important to Stewart County. Houston County has historically relied heavily on agricultural activity, as well as iron ore and timber industries, similar to Stewart County.

Based on the 2019 ACS, construction, retail trade, and manufacturing were among the top two areas of employment in the two low-income EJ-qualifying census block groups. The top three areas of employment by industry for each of the identified EJ-qualifying census block groups is as follows:

- CT 1106 BG 1 (Stewart County) – Construction (17.1 percent); Manufacturing (15.0 percent); and Other services, except public administration (10.8 percent); and
- CT 1203 BG 3 (Houston County) – Retail trade (21.5 percent); Manufacturing (20.0 percent); and Educational services, and health care and social assistance (18.5 percent).

Based on USCB criteria defining rural versus urban, no portions of Stewart or Houston counties are considered urban clusters or urbanized areas, nor are they part of any metropolitan statistical area (MSA).

A review of EJ indices available from USEPA's online EJScreen tool indicated that the percentiles for the EJ-qualifying census block groups as compared to the state were generally slightly above average (above the 50th percentile), indicating the presence of more adverse environmental indicators than across Tennessee. EJ index percentiles for the two EJ-qualifying census block groups ranged from the 29th percentile to the 72nd percentile, with the greater concentration being in the 60s. With the exception of traffic proximity, the EJ-qualifying census block groups generally demonstrated the highest percentiles of each EJ index in comparison with other census block groups in their respective counties. The environmental indicator with the highest percentile (72nd) in the EJ-qualifying census block groups was for the presence of underground storage tanks.

Table 3.4-3. Additional Data for the CUF Reservation Identified EJ Census Block Groups (Low Income)

Geography	% Minority	% Change Population 2010 to 2020 Census	% of Population 65 Years and Over	Median Age	% High School or Higher*	% of Occupied Housing Units, Renter Occupied	Median Year Housing Units Built	% of 16+ Civilian Population in Labor Force	Unemployment Rate	Per Capita Income
Tennessee	*20.4*	*8.9*	*16.0*	*38.7*	*87.5*	*33.7*	*1984*	*61.0*	*3.2*	*$29,859*
Stewart County	*8.2*	*2.5*	*19.6*	*44.2*	*87.2*	*25.0*	*1986*	*52.2*	*6.4*	*$24,113*
CT 1106 BG 1	8.1	-0.3	21.6	48.8	87.5	11.8	1991	48.0	8.6	$21,831
Houston County	*8.0*	*-1.7*	*20.9*	*43.9*	*77.2*	*23.5*	*1981*	*49.8*	*5.9*	*$22,360*
CT 1203 BG 3	0.9	15.5	31.4	51.3	77.7	27.7	1989	34.6	4.3	$34,812

Source: 2019 ACS; 2020 Census

3.4.1.1.4. Limited English Proficiency Populations

Of the 16 census block groups in the CUF Reservation study area, 13 had no individuals who reported speaking English less than well. However, three of the census block groups had individuals who reported speaking English less than well. Those census block groups are:

- CT 1015 BG 2 (Montgomery County)
- 18 individuals (Indo-European languages) out of 2,739 or less than one percent;
- 11 individuals (Asian and Pacific languages) out of 2,739 or less than one percent;
- CT 1106 BG 1 (Stewart County)
- 11 individuals (Spanish) out of 1,644 or less than one percent; and
- CT 1106 BG 2 (Stewart County; CUF)
- two individuals (Spanish) out of 807 or less than one percent.

None of these LEP populations constitute 1,000 individuals or five percent of the population aged five years or older. Based on these findings, the use of translation or interpreter services was not warranted, and no translation services were requested during the NEPA review process.

3.4.1.2. Alternative A

3.4.1.2.1. Natural Gas Pipeline Corridor

The proposed natural gas pipeline lateral would be constructed within Stewart, Houston, and Dickson counties as described in Section 2.1.3.3.2. The one-mile radius surrounding the pipeline corridor, called the pipeline corridor EJ study area, includes all or portions of 10 census block groups (Figure 3.4-1). The 1-mile radius is sufficiently broad considering the likely concentration of construction emissions, noise, and traffic impacts proximal to the pipeline construction and consistent with FERC regulations. (18 CFR § 380.12 Environmental reports for Natural Gas Act applications.) These block groups encompass portions of Stewart, Houston, and Dickson counties, Tennessee.

3.4.1.2.1.1. Minority Populations

No census block groups within the pipeline corridor EJ study area were identified as qualifying minority EJ populations (Table 3.4-4). At the county level, a greater proportion of the populations of Stewart County and all other affected counties self-identified as non-minority than across the associated state, based on the 2019 ACS. Correspondingly, the minority populations in these counties were generally smaller proportionally than statewide.

At the census block group level in the vicinity of the pipeline corridor, based on the 2019 ACS, 6.1 percent of people identified as minorities, a higher proportion than across the study area but a lower proportion than the state. While the overall study area had a substantially lower minority percentage than the state, four of the 10 census block groups within the pipeline corridor EJ study area had higher percentages of minorities in comparison with the overall study area percentage. However, no census block groups in the study area had minority percentages that were 10 percentage points or more above the study area average of 5.7 percent.

While no minority EJ populations were identified in TVA's analysis, Figure 3.4-4 shows the location of the EJ-qualifying minority census block group identified in the TGP EJ analysis for the pipeline (TGP 2022e). These are discussed in Section 3.4.1.2.1.3.

Table 3.4-4. Minority Percentages and Ethnicities in the Pipeline Corridor EJ Study Area

Geography	% Minority	% White[1]	% Black / African American	% Am. Indian / Alaska Native	% Asian	% Native Hawaiian /Pacific Islander	% Some Other Race	Two or More Races	% Hispanic / Latino[2]
Study Area	5.7	94.3	3.4	0.0	0.3	0.1	0.5	1.3	0.9
Pipeline Corridor	6.1	93.9	3.7	0.0	0.3	0.1	0.5	1.4	1.0
Tennessee	*20.4*	*79.6*	*17.9*	*0.9*	*2.2*	*0.1*	*1.6*	*2.0*	*5.4*
Stewart County	*8.2*	*91.8*	*0.9*	*0.2*	*0.7*	*0.4*	*0.0*	*2.9*	*3.0*
CT 1106 BG 2 (Pipeline)	8.5	91.5	2.9	0.3	0.2	0.0	2.0	3.0	2.2
Houston County	*8.0*	*92.0*	*5.4*	*0.7*	*0.2*	*0.2*	*0.0*	*1.1*	*0.4*
CT 1201 BG 2 (Pipeline)	10.9	89.1	7.6	0.0	0.0	0.8	0.0	2.4	0.0
CT 1202 BG 2 (Pipeline)	11.3	88.7	11.3	0.0	0.0	0.0	0.0	0.0	0.0
Dickson County	*10.5*	*89.5*	*4.2*	*0.4*	*0.5*	*0.0*	*0.2*	*1.7*	*3.6*
CT 601 BG 1 (Pipeline)	9.7	90.3	6.5	0.0	2.7	0.0	0.0	0.4	0.7
CT 601 BG 2 (Pipeline)	2.6	97.4	0.1	0.0	0.0	0.0	0.2	2.4	3.5
CT 602 BG 1 (Pipeline)	2.7	97.3	1.2	0.0	0.0	0.0	0.0	1.5	0.4
CT 602 BG 2 (Pipeline)	4.3	95.7	3.4	0.0	0.0	0.0	0.0	0.9	0.0
CT 602 BG 3 (Pipeline)	4.1	95.9	0.7	0.0	0.0	0.0	2.4	1.0	1.8
CT 603 BG 1 (Pipeline)	0.7	99.3	0.0	0.0	0.0	0.0	0.0	0.7	0.0
CT 603 BG 2	2.4	97.6	0.4	0.0	0.0	0.0	0.8	1.1	0.0

Source: 2019 ACS
[1] Race percentages are provided for those reporting a particular race alone or in combination.
[2] This group is calculated separately from the other ethnicities and may include overlap from the other categories, as the USCB does not consider Hispanic or Latino a "race."
Note: Emboldened census block groups represent identified EJ populations as compared with the overall study area percentage.

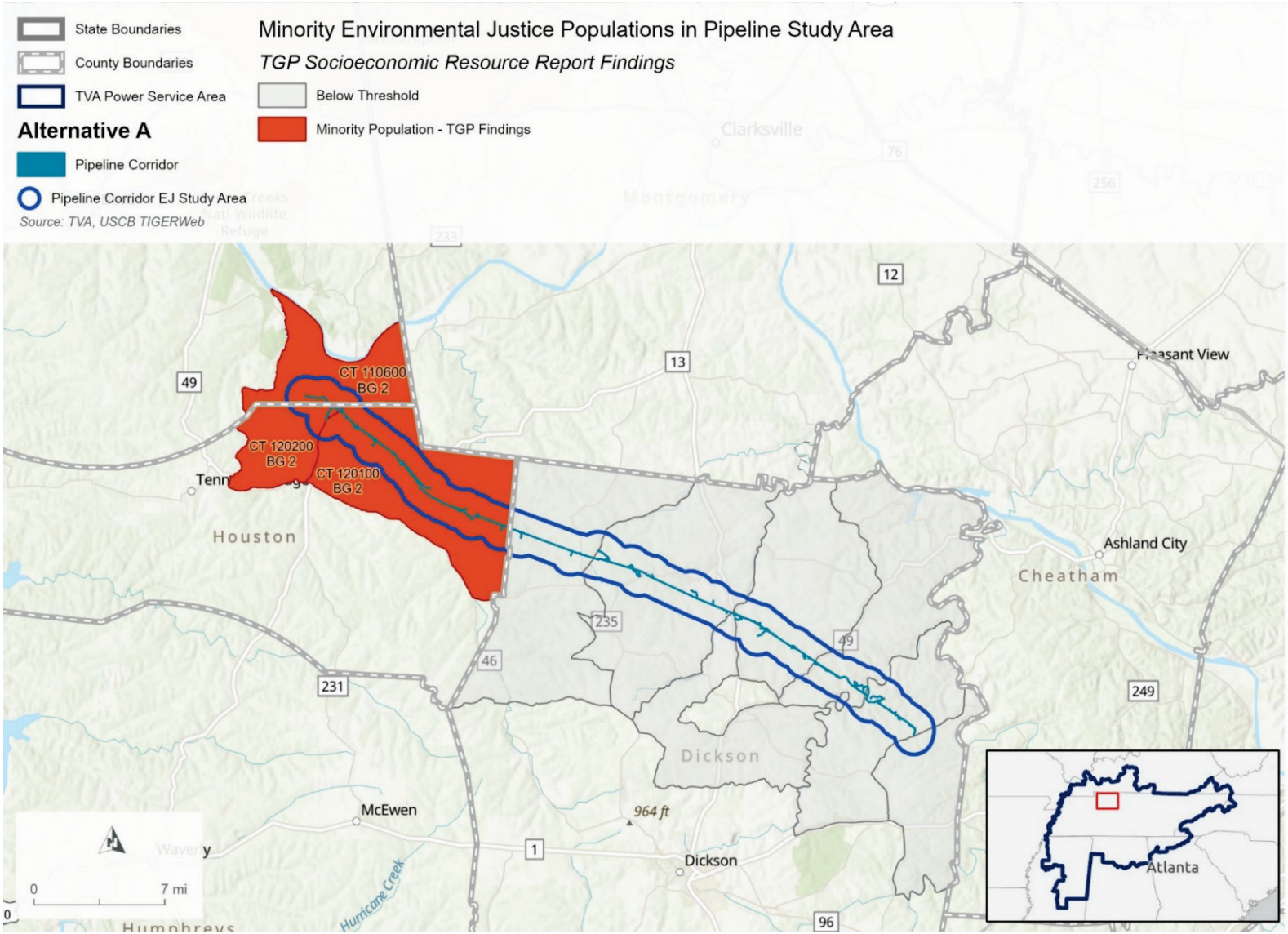

Figure 3.4-4. Minority Environmental Justice Populations in Pipeline Corridor Environmental Justice Study Area

3.4.1.2.1.2. Low-Income Populations

Dickson County CT 602 BG 2 is the one area with qualifying low-income EJ populations (Table 3.4-5). Based on the 2019 SAIPE, a smaller proportion of the population of two of the three affected counties was living in poverty when compared with the state as a whole. In Houston County, the proportion of people living in poverty was higher than the state.

At the census block group level, based on the 2019 ACS, the pipeline corridor EJ study area and the immediate vicinity of the pipeline corridor had higher poverty ratios than the state. In comparison with the whole Alternative A study area, the immediate pipeline corridor had a higher proportion of people living in poverty. Four of the 10 census block groups within the pipeline corridor EJ study area likewise had higher percentages of people living in poverty than across the study area. One census block group had a poverty ratio that was 20 percentage points or more above the study area average of 37.8 percent and/or was at or above 50 percent. This census block group, emboldened in Table 3.4-5, is defined as the area where the chance for amplified environmental and human health effects may be the greatest. Figure 3.4-5 shows the location of the EJ-qualifying low-income census block group identified in this analysis and in the TGP EJ analysis for the pipeline (TGP 2022e).

Table 3.4-5. Poverty Rates for the Pipeline Corridor EJ Study Area

Geography	2019 SAIPE Poverty %*	2019 ACS Poverty %, Households	2019 ACS Poverty Ratio, Two Times US Threshold **
Study Area			37.8
Pipeline Corridor			38.1
Tennessee	*13.8*	*13.2*	*34.9*
Stewart County	*12.9*		
CT 1106 BG 2 (Pipeline)		13.9	38.9
Houston County	*17.8*		
CT 1201 BG 2 (Pipeline)		15.7	35.5
CT 1202 BG 2 (Pipeline)		13.5	47.9
Dickson County	*10.1*		
CT 601 BG 1 (Pipeline)		16.2	32.0
CT 601 BG 2 (Pipeline)		11.3	35.9
CT 602 BG 1 (Pipeline)		25.6	44.4
CT 602 BG 2 (Pipeline)		24.3	**54.9**
CT 602 BG 3 (Pipeline)		6.4	27.7
CT 603 BG 1 (Pipeline)		13.5	32.2
CT 603 BG 2		4.4	36.3

*For the respective county in which the block group is located
**Calculated based on percent of population with a ratio of income to poverty threshold ≤1.99
Source: 2019 SAIPE, 2019 ACS
Note: Emboldened census block groups represent identified EJ populations as compared with the overall study area percentage.

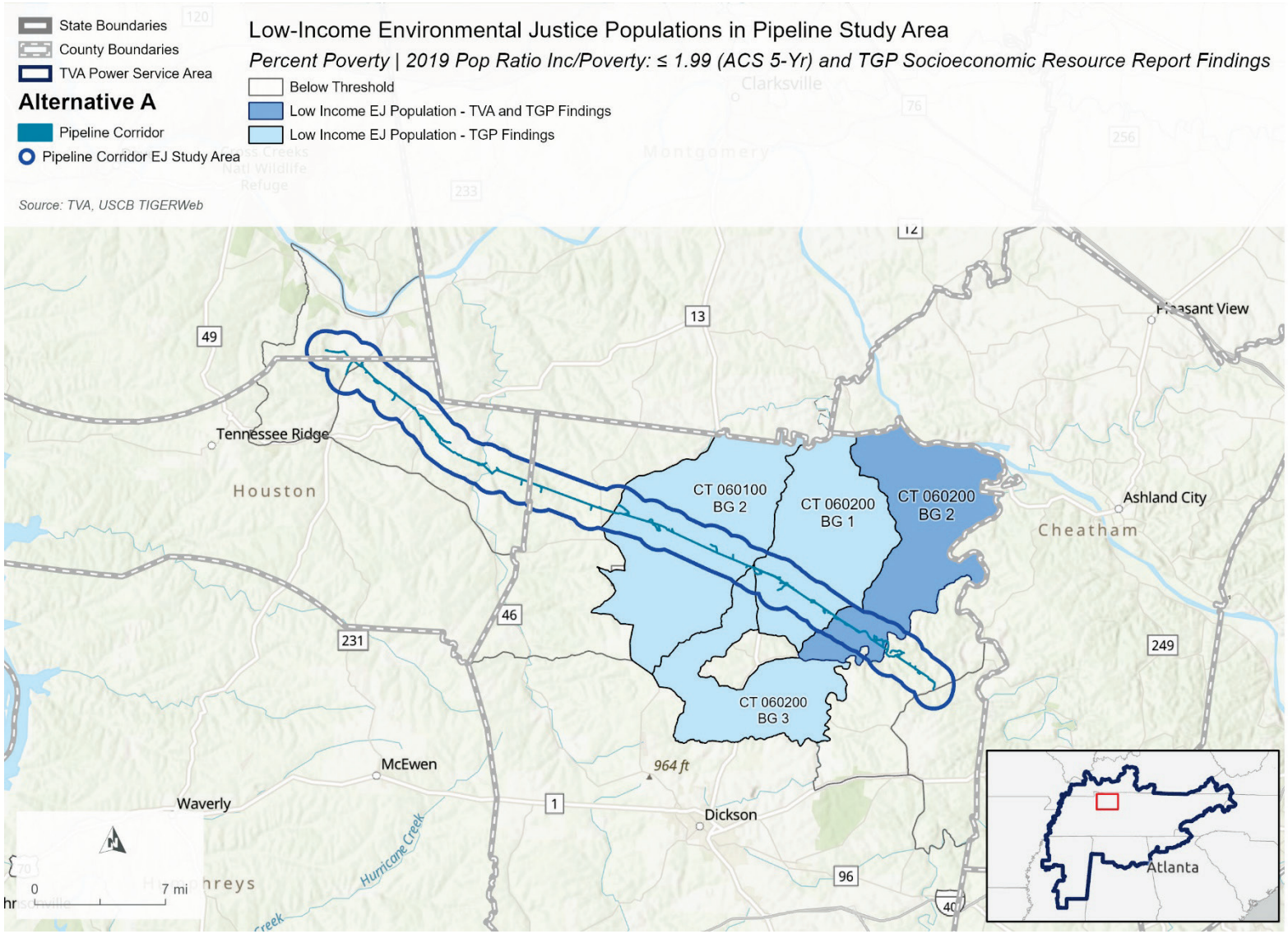

Figure 3.4-5. Low-Income Environmental Justice Populations in Pipeline Corridor Environmental Justice Study Area

3.4.1.2.1.3. Qualifying Environmental Justice Populations

Additional data detail for the one identified EJ-qualifying population, Dickson County CT 602 BG 2, a low-income population, is provided in Table 3.4-6, along with comparison data for the state and county. The table also provides comparable data for six additional census block groups that were identified as EJ-qualifying populations, including three low-income and three minority EJ-qualifying census block groups, under the separate analysis prepared for the pipeline as part of the FERC pre-filing process described in Section 2.1.3.3.

Historical background and rural/urban status was previously provided for Stewart and Houston counties in Section 0. Within Dickson County, only the area around the city of Dickson is an urban cluster. While Dickson County overall is part of the Nashville-Davidson-Murfreesboro-Franklin MSA in Tennessee, all four of the identified study area census block groups in Dickson County are in areas classified as rural.

Based on the 2019 ACS, the educational services, and health care and social assistance category; retail trade category; and manufacturing category were among the top three employment categories in the EJ-qualifying census block groups. The top three areas or categories of employment by industry for each of the identified EJ-qualifying census block groups is as follows:

- CT 602 BG 2 (Dickson County) – Educational services, and health care and social assistance (28.0 percent); Manufacturing (16.8 percent); and Professional, scientific, and management, and administrative, and waste management services (11.4 percent);
- CT 602 BG 1 (Dickson County) – Educational services, and health care and social assistance (26.0 percent); Manufacturing (20.2 percent); and Finance and insurance, and real estate, and rental and leasing (15.1 percent);
- CT 602 BG 3 (Dickson County) – Educational services, and health care and social assistance (34.8 percent); Retail trade (20.7 percent); and Manufacturing (11.2 percent);
- CT 601 BG 2 (Dickson County) – Retail trade (21.5 percent); Educational services, and health care and social assistance (19.5 percent); and Professional, scientific, and management, and administrative, and waste management services (15.7 percent);
- CT 1201 BG 2 (Houston County) – Manufacturing (31.8 percent); Educational services, and health care and social assistance (16.1 percent); and Construction (12.2 percent);
- CT 1202 BG 2 (Houston County) – Educational services, and health care and social assistance (22.6 percent); Manufacturing (17.5 percent); and Construction (12.2 percent); and
- CT 1106 BG 2 (Stewart County) – Retail trade (21.4 percent); Manufacturing (15.6 percent); and Educational services, and health care and social assistance (14.6 percent).

A review of EJ indices available from USEPA's online EJScreen tool indicated that the percentiles for the EJ-qualifying census block groups as compared to the state were generally below average (below the 50th percentile), indicating the presence of fewer adverse environmental indicators than across Tennessee. EJ index percentiles for the EJ-qualifying census block groups ranged from a low of 9th percentile to a high of 72nd percentile, with the indices for other (non-EJ-qualifying) census block groups being predominantly in the 40s and 50s. Only Houston County CT 1202 BG 2 showed a predominance of its EJ indices (eight of 12) being in the 60s. The highest EJ index occurred in Dickson County CT 602 BG 1, due to the presence of underground storage tanks.

Table 3.4-6. Additional Data for the Alternative A Natural Gas Pipeline Identified EJ Census Block Groups (Minority and Low Income)

Geography	% Minority	% Change Population 2010 to 2020 Census	% of Population 65 Years and Over	Median Age	% High School or Higher*	% of Occupied Housing Units, Renter Occupied	Median Year Housing Units Built	% of 16+ Civilian Population in Labor Force	Unemployment Rate	Per Capita Income
Tennessee	*20.4*	*8.9*	*16.0*	*38.7*	*87.5*	*33.7*	*1984*	*61.0*	*3.2*	*$29,859*
Dickson County	*10.5*	*9.4*	*15.5*	*39.1*	*83.7*	*24.9*	*1986*	*58.2*	*3.2*	*$27,115*
CT 602 BG 2	4.3	4.7*	11.0	37.4	67.6	9.2	1987	58.1	0.3	$19,194
CT 602 BG 1	2.7	7.6*	18.6	44.0	85.9	32.1	1982	35.4	0.0	$20,728
CT 602 BG 3	4.1	8.1*	16.2	36.5	80.0	32.4	1985	56.7	9.0	$26,543
CT 601 BG 2	2.6	2.6	16.6	42.4	87.1	17.8	1985	54.6	2.3	$23,343
Houston County	*8.0*	*-1.7*	*20.9*	*43.9*	*77.2*	*23.5*	*1981*	*49.8*	*5.9*	*$22,360*
CT 1201 BG 2	10.9	1.5	15.4	43.4	79.0	25.8	1985	59.0	8.8	$22,806
CT 1202 BG 2	11.3	-6.6	22.4	40.5	81.9	22.4	1970	45.4	4.8	$19,540
Stewart County	*8.2*	*2.5*	*19.6*	*44.2*	*87.2*	*25.0*	*1986*	*52.2*	*6.4*	*$24,113*
CT 1106 BG 2	8.5	-2.0	19.8	39.5	64.6	20.6	1986	47.3	6.9	$20,656

Sources: 2010 Census; 2020 Census
*While the geographic boundary remained the same between the 2010 Decennial Census and the 2020 Decennial Census, the CT BG number changed, respectively, as follows: CT 602 BG 2 to CT 602.01 BG 2; CT 602 BG 1 to CT 602.01 BG 1; and CT 602 BG 3 to CT 602.02 BG 1.

3.4.1.2.1.4. Limited English Proficiency Populations

Of the 10 census block groups in the pipeline corridor EJ study area, seven had no individuals who reported speaking English less than well. However, three of the census block groups had individuals who reported speaking English less than well. Those census block groups were:

- CT 603 BG 1 (Dickson County; Pipeline)
- 13 individuals (Spanish) out of 2,284 or less than one percent;
- CT 603 BG 2 (Dickson County)
- 21 individuals (Spanish) out of 3,098 or less than one percent; and
- CT 1106 BG 2 (Stewart County; Pipeline)
- two individuals (Asian and Pacific Languages) out of 807 or less than one percent.

None of these LEP populations constitute 1,000 individuals or five percent of the population aged five years or older. Therefore, the need for translation or interpreter services is not warranted unless requested.

3.4.1.3. Alternative B

3.4.1.3.1. Johnsonville Reservation

The 10-mile radius surrounding the Johnsonville Reservation, the Johnsonville Reservation EJ study area, includes all or a portion of 19 census block groups (Figure 3.4-1). These block groups encompass portions of Humphreys County, where the Johnsonville Reservation falls within CT 1305 BG 1, and Benton County, Tennessee.

3.4.1.3.1.1. Minority Populations

The census block groups emboldened in Table 3.4-7 represent areas with identified minority EJ populations. At the county level, a greater proportion of the populations of the two affected counties identified as non-minority than across Tennessee, based on the 2019 ACS. Correspondingly, the minority populations in these counties were generally smaller proportionally than statewide.

At the census block group level, based on the 2019 ACS, in the vicinity of the Johnsonville Reservation, 22.8 percent of people identified as minorities, a greater proportion than across the study area and the state. While the overall study area had a lower minority percentage than the state, nine of the 19 census block groups within the Johnsonville Reservation EJ study area had higher percentages of minorities in comparison with the overall study area percentage. Two census block groups had minority percentages that were 10 percentage points or more above the study area average of 7.4 percent (Figure 3.4-6). These areas, emboldened in Table 3.4-7, are considered minority EJ population areas, where the chance for amplified environmental and human health effects may be the greatest.

Additional data detail for CT 1305 BG 1 and CT 9631 BG 2 is provided in Table 3.4-8, along with comparison data for the state and respective county.

Table 3.4-7. Minority Percentages and Ethnicities in the Johnsonville Reservation EJ Study Area

Geography	% Minority	% White[1]	% Black / African American	% Am. Indian / Alaska Native	% Asian	% Native Hawaiian /Pacific Islander	% Some Other Race	Two or More Races	% Hispanic / Latino[2]
Study Area	7.4	92.6	4.0	0.6	0.2	0.0	0.0	2.5	2.3
Johnsonville Reservation	22.8	77.2	11.5	10.5	0.0	0.0	0.0	0.7	0.1
Tennessee	*20.4*	*79.6*	*17.9*	*0.9*	*2.2*	*0.1*	*1.6*	*2.0*	*5.4*
Humphreys County	*7.5*	*92.5*	*2.1*	*0.8*	*0.7*	*0.0*	*0.0*	*1.5*	*2.5*
CT 1305 BG 1 (Johnsonville)	**22.8**	77.2	11.5	10.5	0.0	0.0	0.0	0.7	0.1
CT 1302 BG 2	5.7	94.3	0.0	0.0	0.0	0.0	0.0	5.7	0.0
CT 1303 BG 1	16.5	83.5	16.5	0.0	0.0	0.0	0.0	0.0	0.0
CT 1303 BG 5	12.1	87.9	6.2	0.0	0.0	0.0	0.0	5.9	9.0
CT 1304 BG 2	4.2	95.8	3.9	0.0	0.0	0.0	0.2	0.0	0.4
CT 1305 BG 2	5.4	94.6	1.2	0.0	0.8	0.0	0.0	3.4	0.0
CT 1305 BG 3	13.4	86.6	3.0	0.0	0.0	0.0	0.0	10.5	2.4
Benton County	*7.3*	*92.7*	*3.0*	*0.4*	*0.0*	*0.0*	*0.0*	*1.4*	*2.4*
CT 9630 BG 2	2.1	97.9	0.0	1.8	0.3	0.0	0.0	0.0	2.8
CT 9631 BG 1	2.6	97.4	0.0	0.0	2.6	0.0	0.0	0.0	2.6
CT 9631 BG 2	**19.9**	80.1	8.2	2.7	0.0	0.0	0.0	9.0	0.0
CT 9631 BG 3	11.6	88.4	11.6	0.0	0.0	0.0	0.0	0.0	27.8
CT 9632 BG 1	10.0	90.0	9.1	0.0	0.0	0.0	0.0	0.9	1.7
CT 9632 BG 2	7.5	92.5	0.9	0.0	0.0	0.0	0.0	6.7	1.9
CT 9633 BG 1	0.9	99.1	0.9	0.0	0.0	0.0	0.0	0.0	0.4
CT 9633 BG 2	3.1	96.9	1.3	0.0	0.0	0.0	0.0	1.8	0.0
CT 9633 BG 3	1.5	98.5	1.5	0.0	0.0	0.0	0.0	0.0	1.4
CT 9634 BG 1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CT 9634 BG 2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CT 9634 BG 3	8.7	91.3	7.5	0.0	0.0	0.0	0.0	1.2	0.0

Source: 2019 ACS

[1] Race percentages are provided for those reporting a particular race alone or in combination. Less than 3 percent of the US population reported two or more races in the 2010 Census; thus, these percentages are closely representative of the whole ethnic group population.

[2] This group is calculated separately from the other ethnicities and may include overlap from the other categories, as the USCB does not consider Hispanic or Latino a "race."

Note: Emboldened census block groups represent identified EJ populations as compared with the overall study area percentage.

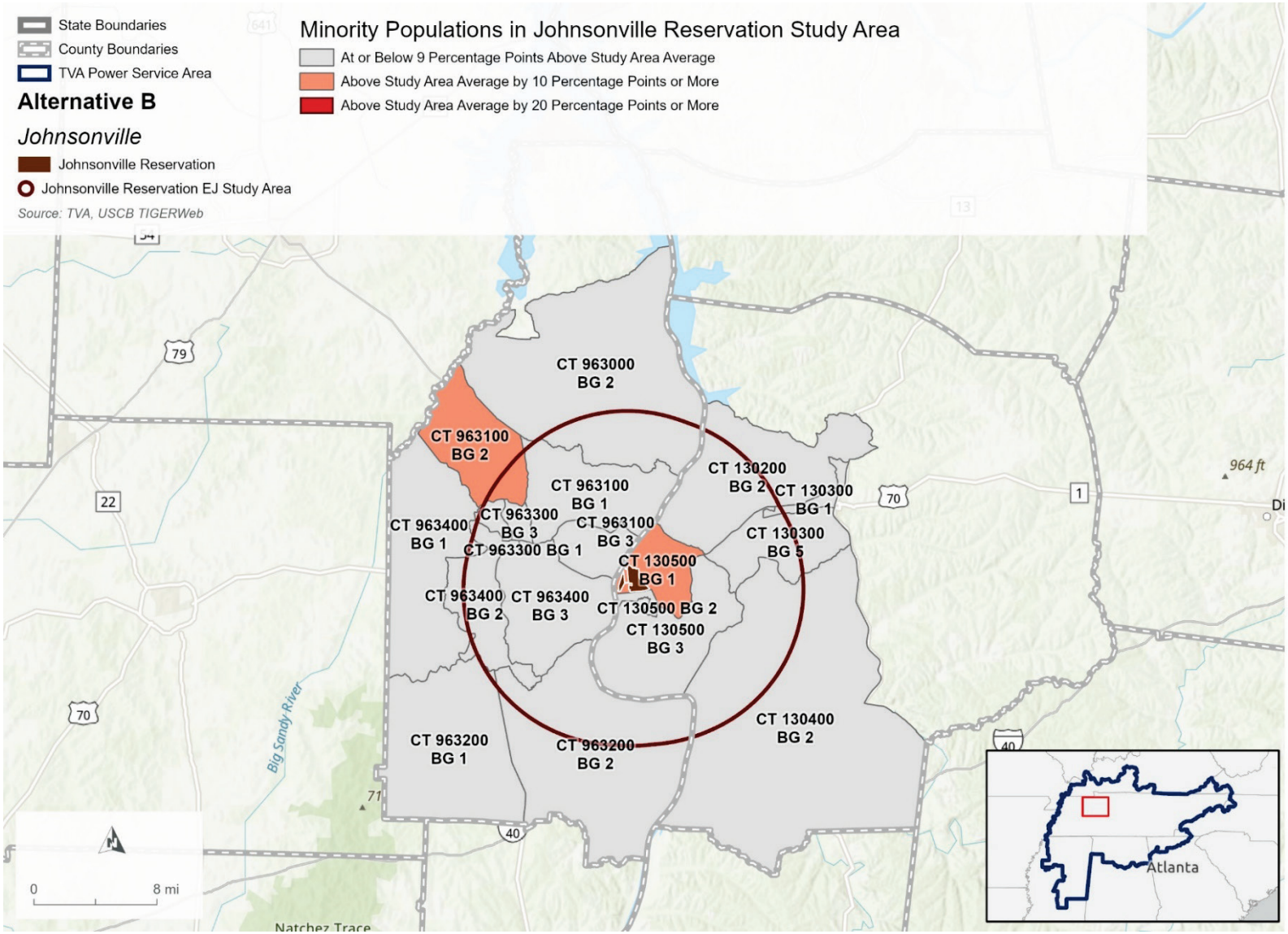

Figure 3.4-6. Minority Populations in Johnsonville Reservation Environmental Justice Study Area

3.4.1.3.1.2. Low-Income Populations

Emboldened census block groups in Table 3.4-8 represent areas with identified low-income EJ populations. Based on the 2019 SAIPE, a smaller proportion of the population of Humphreys County was living in poverty when compared with the state as a whole. In Benton County, the proportion of the population living in poverty was higher than across Tennessee.

Table 3.4-8. Poverty Rates for the Johnsonville Reservation EJ Study Area

	2019 SAIPE	2019 ACS	
Geography	**Poverty %***	**Poverty %, Households**	**Poverty Ratio, Two Times US Threshold ** **
Study Area			42.2
Johnsonville Reservation			35.6
Tennessee	*13.8*	*13.2*	*34.9*
Humphreys County	*13.1*		
CT 1305 BG 1 (Johnsonville)		8.4	35.6
CT 1302 BG 2		20.9	47.0
CT 1303 BG 1		35.6	**53.3**
CT 1303 BG 5		19.3	42.0
CT 1304 BG 2		11.0	32.3
CT 1305 BG 2		15.8	28.0
CT 1305 BG 3		10.5	30.8
Benton County	*17.6*		
CT 9630 BG 2		19.5	31.1
CT 9631 BG 1		11.8	33.8
CT 9631 BG 2		16.7	31.3
CT 9631 BG 3		23.4	34.8
CT 9632 BG 1		18.8	46.7
CT 9632 BG 2		18.9	45.5
CT 9633 BG 1		12.8	46.5
CT 9633 BG 2		36.2	**60.5**
CT 9633 BG 3		13.2	40.5
CT 9634 BG 1		17.9	**67.3**
CT 9634 BG 2		29.4	43.4
CT 9634 BG 3		24.8	**50.9**

*For the respective county in which the block group is located
**Calculated based on percent of population with a ratio of income to poverty threshold ≤1.99
Source: 2019 SAIPE, 2019 ACS
Note: Emboldened census block groups represent identified EJ populations as compared with the overall study area percentage.

At the census block group level, based on the 2019 ACS, the Johnsonville Reservation EJ study area as a whole and the immediate Johnsonville Reservation vicinity had higher poverty ratios than across the state. Nine of the 19 census block groups within the Johnsonville Reservation EJ study area had higher percentages of people living in poverty than across the study area. Four census block groups had poverty ratios that were 20 percentage points or more above the study area average of 42.2 percent and/or were at or above 50 percent (Figure 3.4-7). These areas, emboldened in Table 3.4-8, are considered low-income EJ populations, where the chance for amplified environmental and human health effects may be the greatest.

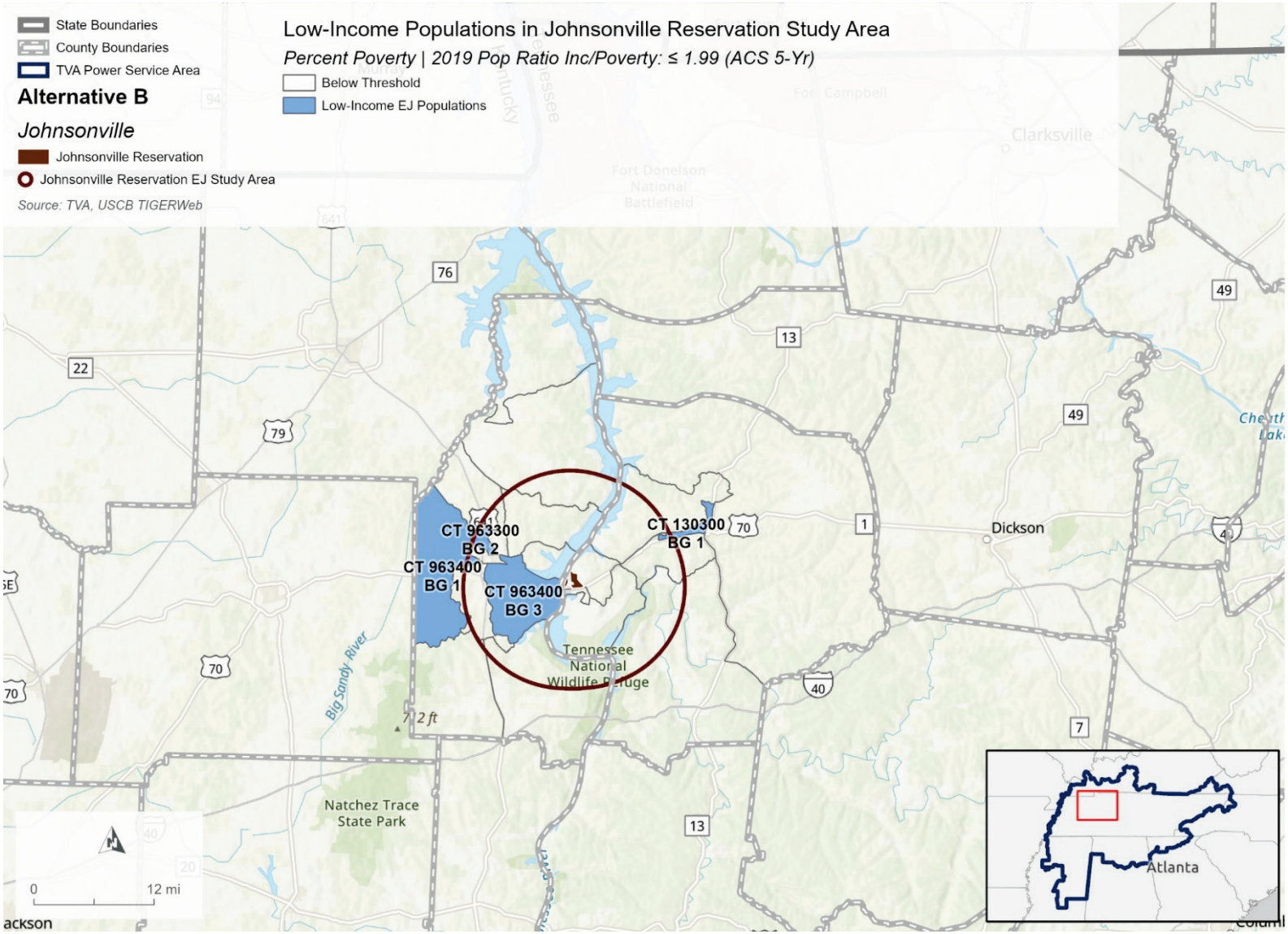

Figure 3.4-7. Low-Income Populations in Johnsonville Reservation Environmental Justice Study Area

3.4.1.3.1.3. Qualifying Environmental Justice Populations

Additional data detail for the EJ-qualifying populations, consisting of two minority census block groups, Humphreys County CT 1305 BG 1 and Benton County CT 9631 BG 2, and three low-income census block groups, Humphreys County CT 1303 BG 1 and Benton County CT 9633 BG 2, CT 9634 BG 1, and CT 9634 BG 3, is provided in Table 3.4-9, along with comparison data for the state and county.

Humphreys County originally included land on both sides of the Tennessee River in what is now Benton County and historically had a strong agricultural base and a connection to iron ore operations (Blankenship et al 2019). The area was agricultural and rural well into the twentieth century, while much of the nation was experiencing more rapid industrial development. The creation of Kentucky Reservoir in the mid-twentieth century, however, served as a catalyst for industrial development of the county, and the city of Waverly, located east of New Johnsonville and Humphreys County CT 1305 BG 1, became the commerce center for the county. The city of New Johnsonville was borne out of Johnsonville, which was flooded to create Kentucky Reservoir.

The EJ-qualifying areas within the Johnsonville Reservation EJ study area are rural. In Humphreys County, only the city of Waverly is an urban cluster based on USCB criteria, and Humphreys County CT 1305 BG 1 is located in a rural area outside of Waverly. Similarly, in Benton County, only the city of Camden is an urban cluster, but Benton County CT 9631 BG 2 is outside of this area and is characterized as rural. Neither Humphreys County nor Benton County is part of an MSA.

Based on the 2019 ACS, the top three areas of employment by industry for the EJ-qualifying census block groups are as follows:

- CT 1305 BG 1 (Humphreys County) – Manufacturing (31.3 percent); Educational services, and health care and social assistance (18.4 percent); and Transportation and warehousing, and utilities (15.6 percent);
- CT 1303 BG 1 (Humphreys County) – Manufacturing (71.7 percent); Agriculture, forestry, fishing and hunting, and mining (7.4 percent); and Retail trade (6.3 percent);
- CT 9631 BG 2 (Benton County) – Arts, entertainment, and recreation, and accommodation and food services (15.4 percent); Educational services, and health care and social assistance (13.3 percent); and Manufacturing (12.1 percent);
- CT 9633 BG 2 (Benton County) – Manufacturing (42.7 percent); Finance and insurance, and real estate, and rental and leasing (12.3 percent); and Arts, entertainment, and recreation, and accommodation and food services (8.7 percent);
- CT 9634 BG 1 (Benton County) – Educational services, and health care and social assistance (21.2 percent); Manufacturing (15.9 percent); and Retail trade (15.9 percent); and
- CT 9634 BG 3 (Benton County) – Manufacturing (19.0 percent); Retail trade (16.9 percent); and Transportation and warehousing, and utilities (16.9 percent).

A review of EJ indices available from USEPA's online EJScreen tool indicated that the percentiles for the EJ-qualifying census block groups as compared to the state were generally average to slightly above average (at the 50th percentile or slightly above), indicating the presence of similar to slightly more adverse environmental indicators as compared to Tennessee. EJ index percentiles for the EJ-qualifying minority census block groups ranged from a low of 19th percentile to a high of 68th percentile. In Humphreys County CT 1305 BG 1, the EJ indices ranged from a low of 19th percentile for wastewater discharge to a high of 68th percentile for diesel particulate matter. For Benton County CT 9631 BG 2, nearly all EJ index percentiles were in the 50s and 60s, with only one being below average (42nd percentile for lead paint). The highest percentile for this census block group was 66 for wastewater discharge. EJ index percentiles for the EJ-qualifying low-income census block groups ranged from a low of 26th percentile to a high of 70th percentile, with indices for nearly all block groups being predominantly in the 50s and 60s. Humphreys County CT 1303 BG 1 showed a predominance of its EJ indices being higher than these, with eight of 12 being at the 70th percentile, for particulate matter 2.5, ozone, diesel particulate matter, air toxics cancer risk, air toxics respiratory hazard index, Superfund site proximity, risk management plan facility proximity, and hazardous waste facility proximity.

Table 3.4-9. Additional Data for the Alternative B Johnsonville Identified EJ Census Block Groups (Minority and Low Income)

Geography	% Minority	Poverty Ratio, Two Times US Threshold	% Change Population 2010 to 2020 Census	% of Population 65 Years and Over	Median Age	% High School or Higher*	% of Occupied Housing Units, Renter Occupied	Median Year Housing Units Built	% of 16+ Civilian Population in Labor Force	Unemployment Rate	Per Capita Income
Tennessee	*20.4*	*34.9*	*8.9*	*16.0*	*38.7*	*87.5*	*33.7*	*1984*	*61.0*	*3.2*	*$29,859*
Humphreys County	*7.5*	*36.3*	*2.4*	*19.3*	*42.0*	*84.9*	*22.2*	*1980*	*53.3*	*7.5*	*$25,428*
CT 1305 BG 1 (Johnsonville; Minority)	22.8	35.6	23.9*	12.4	43.0	89.7	9.4	1981	54.7	19.2	$21,794
CT 1303 BG 1 (Low income)	16.5	53.3	13.4	21.7	45.1	80.8	66.6	1968	53.7	14.6	$18,589
Benton County	*7.3*	*44.7*	*-3.8*	*23.8*	*47.9*	*82.4*	*22.9*	*1985*	*47.4*	*6.8*	*$22,636*
CT 9631 BG 2 (Minority)	19.9	31.3	-6.8	19.1	41.2	92.2	19.2	1989	60.5	9.4	$27,014
CT 9633 BG 2 (Low income)	3.1	60.5	8.8	21.6	38.4	84.6	54.0	1969	50.2	4.9	$18,849
CT 9634 BG 1 (Low income)	0.0	67.3	-7.1	13.6	44.6	74.6	14.1	1987	59.6	8.4	$15,364
CT 9634 BG 3 (Low income)	8.7	50.9	-11.6	29.1	51.8	81.3	14.7	1987	38.7	1.1	$19,619

Sources: 2010 Census; 2020 Census
*For the 2020 Decennial Census, CT 1305 BG 1 and CT 1305 BG 2 from the 2010 Decennial Census were combined into one CT BG boundary, so no calculation of the percent change in population between 2010 and 2020 was possible. The percent change presented is calculated based on the 2010 Decennial Census and 2019 ACS 5-Year Estimates, which have the same CT BG geographic boundaries.

3.4.1.3.1.4. Limited English Proficiency Populations

Of the 19 census block groups in the Johnsonville Reservation EJ study area, 18 had no individuals who reported speaking English less than well. However, one census block group, CT 9633 BG 3, had 19 individuals who reported speaking English less than well. All of these individuals were 65 years of age or older and categorized as not speaking English at all. This number represents 1.5 percent of the 1,251 persons aged five years and older living in the census block group. This identified LEP population does not constitute 1,000 individuals or five percent of the population aged five years or older. Therefore, the need for translation or interpreter services is not warranted unless requested.

3.4.1.3.2. Gleason Reservation

The 10-mile radius surrounding the Gleason Reservation, called the Gleason Reservation EJ study area, includes all or a portion of 15 census block groups (Figure 3.4-1). These block groups encompass portions of Weakley County, where the Gleason Reservation falls within CT 9685 BG 1, and Henry County, Tennessee.

3.4.1.3.2.1. Minority Populations

The census block group emboldened in Table 3.4-10 represents the one area with identified minority EJ populations. At the county level, a greater proportion of the populations of the two affected counties were identified as non-minority than across Tennessee, based on the 2019 ACS. Correspondingly, the minority populations in these counties were generally smaller proportionally than statewide.

At the census block group level, based on the 2019 ACS, in the vicinity of the Gleason Reservation, 4.4 percent of people identified as minorities, a smaller proportion than across the study area and the state. While the overall study area had a lower minority percentage than the state, four of the 15 census block groups within the Gleason Reservation EJ study area had higher percentages of minorities in comparison with the overall study area percentage. One census block group had a minority percentage that was 10 percentage points or more above the study area average of 5.8 percent (Figure 3.4-8). This area, emboldened in Table 3.4-10, is considered a minority EJ population area, where the chance for amplified environmental and human health effects may be the greatest. This same census block group is also identified as a low-income EJ population area; additional detail for Weakley County CT 9684 BG 2 is provided in Section 3.4.1.3.2.2 and Section 3.4.1.3.2.3.

Table 3.4-10. Minority Percentages and Ethnicities in the Gleason Reservation EJ Study Area

Geography	% Minority	% White[1]	% Black / African American	% Am. Indian / Alaska Native	% Asian	% Native Hawaiian /Pacific Islander	% Some Other Race	Two or More Races	% Hispanic /Latino[2]
Study Area	5.8	94.2	3.7	0.2	0.2	0.0	0.7	1.0	1.8
Gleason Reservation	4.4	95.6	2.2	0.0	0.0	0.0	0.2	2.0	1.4
Tennessee	*20.4*	*79.6*	*17.9*	*0.9*	*2.2*	*0.1*	*1.6*	*2.0*	*5.4*
Weakley County	13.2	86.8	8.4	0.4	0.3	0.1	0.2	1.3	2.6
CT 9685 BG 1 (Gleason)	4.4	95.6	2.2	0.0	0.0	0.0	0.2	2.0	1.4
CT 9683 BG 2	13.6	86.4	11.0	0.0	0.8	0.0	0.0	1.8	0.0
CT 9684 BG 1	5.8	94.2	1.5	0.0	0.0	0.0	4.3	0.0	4.3
CT 9684 BG 2	**19.3**	80.7	19.3	0.0	0.0	0.0	0.0	0.0	0.0
CT 9684 BG 3	5.2	94.8	0.0	0.0	0.0	0.0	5.2	0.0	5.2
CT 9684 BG 4	4.6	95.4	4.2	0.3	0.0	0.0	0.0	0.0	0.0
CT 9684 BG 5	6.6	93.4	5.3	1.3	0.0	0.0	0.0	0.0	4.0
CT 9685 BG 2	4.2	95.8	1.5	0.4	0.3	0.0	0.0	2.0	0.0
CT 9685 BG 3	3.2	96.8	1.5	0.5	0.0	0.0	0.0	1.1	2.2
CT 9686 BG 2	3.9	96.1	3.1	0.0	0.5	0.0	0.0	0.4	2.4
CT 9686 BG 3	2.9	97.1	0.4	0.0	1.4	0.0	0.0	1.2	0.8
CT 9687 BG 1	2.9	97.1	0.6	0.0	0.0	0.0	2.4	0.0	0.0
CT 9687 BG 2	0.4	99.6	0.0	0.4	0.0	0.0	0.0	0.0	0.0
Henry County	12.7	87.3	8.2	0.3	0.4	0.0	0.0	1.3	2.6
CT 9692 BG 2	6.4	93.6	5.5	0.0	0.0	0.0	0.0	0.9	4.5
CT 9698 BG 1	3.8	96.2	1.2	0.0	0.0	0.0	0.0	2.6	3.1

Source: 2019 ACS

[1] Race percentages are provided for those reporting a particular race alone or in combination. Less than 3 percent of the US population reported two or more races in the 2010 Census; thus, these percentages are closely representative of the whole ethnic group population.

[2] This group is calculated separately from the other ethnicities and may include overlap from the other categories, as the USCB does not consider Hispanic or Latino a “race.”

Note: Emboldened census block groups represent identified EJ populations as compared with the overall study area percentage.

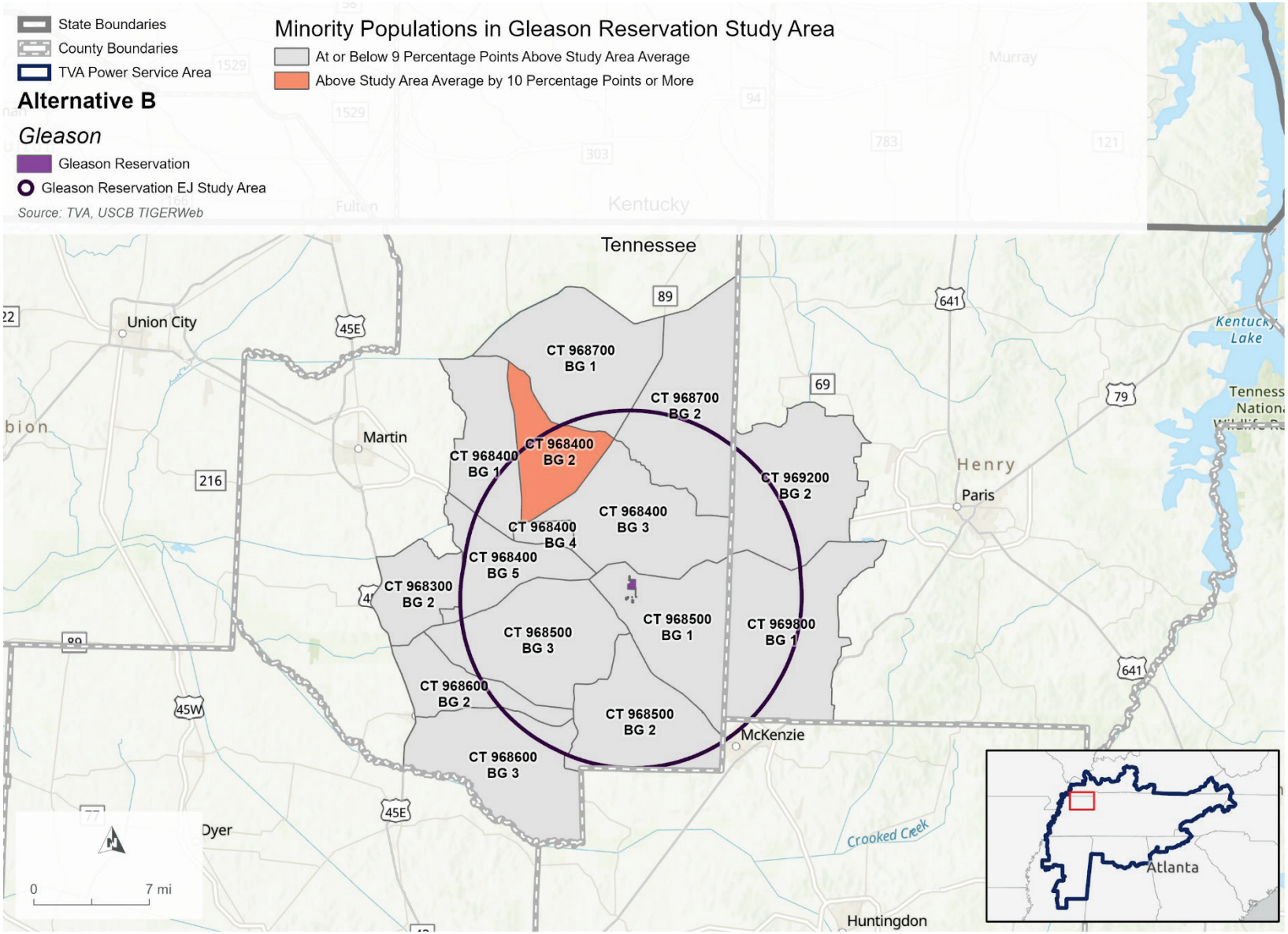

Figure 3.4-8. Minority Populations in Gleason Reservation Environmental Justice Study Area

3.4.1.3.2.2. Low-Income Populations

The census block groups emboldened in Table 3.4-11 represent areas with identified low-income EJ populations. Based on the 2019 SAIPE, a smaller proportion of the population of Weakley County was living in poverty when compared with the state as a whole. In Henry County, the proportion of the population living in poverty was higher than across Tennessee.

At the census block group level, based on the 2019 ACS, both the Gleason Reservation EJ study area and the immediate vicinity of the Gleason Reservation had higher poverty rates than the state. Likewise, nine of the 15 census block groups within the Gleason Reservation EJ study area had higher percentages of people living in poverty than across the study area. Four census block groups had poverty ratios that were 20 percentage points or more above the study area average of 42.2 percent and/or were at or above 50 percent (Figure 3.4-9). These areas, emboldened in Table 3.4-11, are considered low-income EJ populations, where the chance for amplified environmental and human health effects may be the greatest.

Table 3.4-11. Poverty Rates for the Gleason Reservation EJ Study Area

Geography	2019 SAIPE Poverty %*	2019 ACS Poverty %, Households	2019 ACS Poverty Ratio, Two Times US Threshold **
Study Area			42.2
Gleason Reservation			41.9
Tennessee	*13.8*	*13.2*	*34.9*
Weakley County	*13.1*		
CT 9685 BG 1 (Gleason)		13.4	41.9
CT 9683 BG 2		17.3	39.3
CT 9684 BG 1		16.7	40.6
CT 9684 BG 2		0.0	**56.3**
CT 9684 BG 3		0.0	18.9
CT 9684 BG 4		16.7	46.2
CT 9684 BG 5		10.9	32.7
CT 9685 BG 2		27.2	**56.0**
CT 9685 BG 3		13.7	46.4
CT 9686 BG 2		17.8	42.5
CT 9686 BG 3		22.1	32.5
CT 9687 BG 1		12.2	**57.0**
CT 9687 BG 2		16.2	40.7
Henry County	*18.3*		
CT 9692 BG 2		8.6	32.4
CT 9698 BG 1		20.9	**50.5**

*For the respective county in which the block group is located
**Calculated based on percent of population with a ratio of income to poverty threshold ≤1.99
Source: 2019 SAIPE, 2019 ACS
Note: Emboldened census block groups represent identified EJ populations as compared with the overall study area percentage.

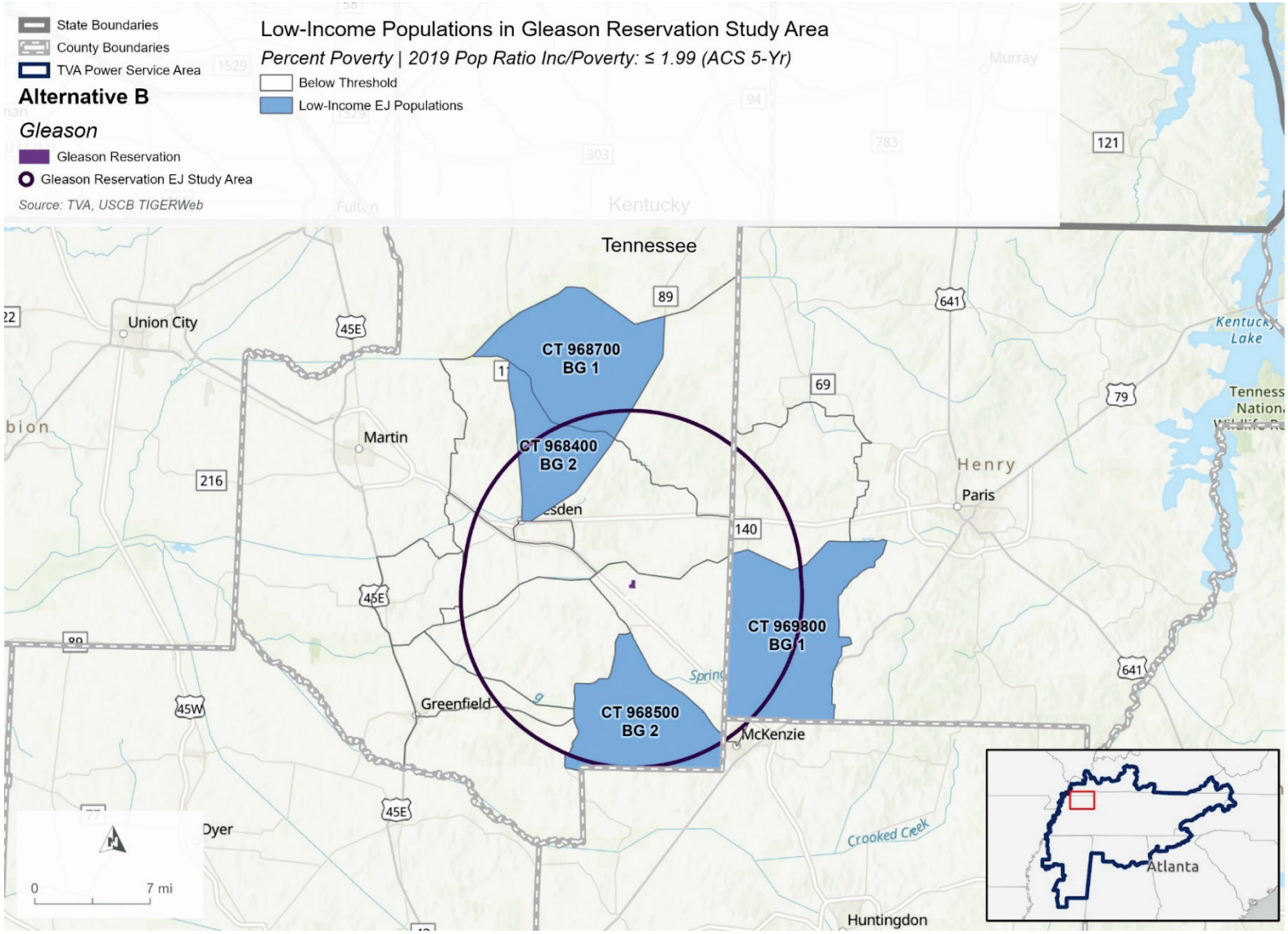

Figure 3.4-9. Low-Income Populations in Gleason Reservation Environmental Justice Study Area

3.4.1.3.2.3. Qualifying Environmental Justice Populations

Additional data detail for the EJ-qualifying census block groups, consisting of one minority and low-income area, Weakley County CT 9684 BG 2, and three low-income areas, Weakley County CT 9685 BG 2 and CT 9687 BG 1 and Henry County CT 9698 BG 1, is provided in Table 3.4-12, along with comparison data for the state and respective county.

Weakley County historically relied on an agricultural-based economy focused on corn production, becoming the state's largest corn-producing county by 1880 (McKee and Karpynec 2009). Agricultural activity continued through an evolution of reliance on livestock, cotton, soybean, and wheat production, with the latter two still prominent today. The advent of the railroad spurred the county's industrial growth in the late 1870s, leading to increased manufacturing growth in the twentieth century as well. Both Weakley and Henry counties remain largely rural. Within Weakley County, only Martin is within an urban cluster based on USCB criteria; however, all three EJ-qualifying census block groups within Weakley are located in rural areas outside of this urban cluster. Paris within Henry County is an urban cluster, but Henry County CT 9698 BG 1 is outside of this cluster and is characterized as rural. Neither county is part of an MSA.

The following list shows the top three areas of employment by industry for each of the EJ-qualifying census block groups, based on the 2019 ACS:

- CT 9684 BG 2 (Weakley County) – Manufacturing (29.5 percent); Arts, entertainment, and recreation, and accommodation and food services (29.5 percent); and Retail trade (11.8 percent);
- CT 9685 BG 2 (Weakley County) – Retail trade (26.0 percent); Educational services, and health care and social assistance (17.1 percent); and Manufacturing (14.8 percent);
- CT 9687 BG 1 (Weakley County) – Transportation and warehousing, and utilities (30.1 percent); Educational services, and health care and social assistance (18.9 percent); and Manufacturing (16.9 percent); and
- CT 9698 BG 1 (Henry County) – Educational services, and health care and social assistance (26.1 percent); Manufacturing (14.0 percent); and Retail trade (11.9 percent).

A review of EJ indices available from USEPA's online EJScreen tool indicated that the percentiles for the EJ-qualifying census block groups as compared to the state were generally slightly above average (slightly above the 50th percentile), indicating the presence of slightly more adverse environmental indicators as compared to Tennessee. EJ indices percentiles for the EJ-qualifying census block groups ranged from the 42nd percentile to the 72nd percentile, with the predominance of percentiles in the 60s. The highest EJ index percentile, found in Weakley County CT 9687 BG 1, is for underground storage tanks. Weakley County CT 9684 BG 2 differs from the other EJ-qualifying census block groups in that its percentiles are nearly all in the 70s, with only one of its indices (traffic proximity) slightly below that, at the 69th percentile.

Table 3.4-12. Additional Data for the Alternative B Gleason Identified EJ Census Block Groups (Minority and Low Income)

Geography	% Minority	Poverty Ratio, Two Times US Threshold	% Change Population 2010 to 2020 Census	% of Population 65 Years and Over	Median Age	% High School or Higher*	% of Occupied Housing Units, Renter Occupied	Median Year Housing Units Built	% of 16+ Civilian Population in Labor Force	Unemployment Rate	Per Capita Income
Tennessee	*20.4*	*34.9*	*8.9*	*16.0*	*38.7*	*87.5*	*33.7*	*1984*	*61.0*	*3.2*	*$29,859*
Weakley County	*13.2*	*44.6*	*-6.1*	*18.0*	*38.6*	*85.1*	*34.7*	*1977*	*54.4*	*5.6*	*$22,755*
CT 9684 BG 2	19.3	56.3	-9.6	9.1	41.8	89.0	41.4	1975	65.1	14.1	$17,731
CT 9685 BG 2	4.2	56.0	-3.2	10.7	30.7	77.7	22.8	1984	52.3	4.9	$16,683
CT 9687 BG 1	2.9	57.0	-8.8	20.3	43.6	80.5	10.1	1979	43.2	3.3	$18,021
Henry County	*12.7*	*44.4*	*-0.4*	*22.8*	*45.8*	*85.9*	*23.8*	*1981*	*50.1*	*4.7*	*$24,124*
CT 9698 BG 1	3.8	50.5	-1.0	21.0	42.5	86.6	12.7	1983	57.3	5.9	$30,612

Sources: 2010 Census; 2020 Census

3.4.1.3.2.4. Limited English Proficiency Populations

Of the 15 census block groups within the 10-mile radius of the Gleason Reservation, 13 had no individuals who reported speaking English less than well. Two of the census block groups did, however, have individuals speaking English less than well. Those census block groups were:

- CT 9683 BG 2 (Weakley County)
    - Six individuals (Spanish) out of 1,524 or less than one percent; and
- CT 9685 BG 3 (Weakley County)
    - 11 individuals (Spanish) out of 1,438 or less than one percent.

None of these LEP populations constitute 1,000 individuals or five percent of the population aged five years or older. Therefore, the need for translation or interpreter services is not warranted unless requested.

3.4.1.3.3. Transmission Corridor

The 40-mile 500-kV TL corridor proposed under Alternative B is within Weakley and Henry counties, where the minority percentages are below that of the state, as demonstrated in Table 3.4-11. Based on the 2019 SAIPE and as shown on Table 3.4-12, a smaller proportion of the population of Weakley County was living in poverty when compared with the state as a whole. In Henry County, the proportion of the population living in poverty was higher than across Tennessee.

3.4.1.4. Alternative C

3.4.1.4.1. Middle Tennessee TVA Power Service Area

The Alternative C EJ study area consists of the Middle Tennessee region, as based on regions in the TVA PSA defined by the TVA Economic Development team (TVA 2022e; Figure 3.4-2). The Alternative C EJ study area is separated into its 24 associated counties for evaluation purposes.

3.4.1.4.1.1. Minority Populations

The emboldened county in Table 3.4-13 represents a minority EJ population area within the Alternative C EJ study area. The overall study area and five of the 24 counties had higher minority percentages than the state. One county, Davidson County, had a minority percentage that was 10 percentage points or more above the study area average of 20.4 percent. This area, emboldened in Table 3.4-13, is considered a minority EJ population area, where the chance for amplified environmental and human health effects may be the greatest.

Table 3.4-13. Minority Percentages and Ethnicities in the EJ Study Area for Alternative C

Geography	% Minority	% White[1]	% Black/ African American	% Am Indian /Alaska Native	% Asian	% Native Hawaiian /Pacific Islander	% Some Other Race	% Hispanic /Latino[2]
Study Area	27.0	73.0	14.3	0.2	2.4	<0.1	0.3	7.2
Tennessee County	*20.4*	*79.6*	*17.9*	*0.9*	*2.2*	*0.1*	*1.6*	*5.4*

Geography	% Minority	% White[1]	% Black/ African American	% Am Indian /Alaska Native	% Asian	% Native Hawaiian /Pacific Islander	% Some Other Race	% Hispanic /Latino[2]
Bedford	23.2	76.8	7.9	0.2	0.2	0.0	0.6	12.4
Cheatham	7.5	92.5	1.6	0.4	0.4	0.0	0.3	3.0
Coffee	11.6	88.4	3.8	0.0	1.1	0.0	0.3	4.3
Davidson	**43.8**	56.2	26.9	0.2	3.6	0.1	0.4	10.2
Dickson	10.5	89.5	4.2	0.4	0.5	0.0	0.2	3.6
Franklin	11.6	88.4	4.5	0.0	0.4	0.1	0.3	3.4
Giles	15.9	84.1	9.7	0.3	0.2	0.0	0.5	2.5
Hickman	9.6	90.4	5.2	0.2	0.4	0.0	0.0	2.5
Houston	8.0	92.0	5.4	0.7	0.2	0.2	0.0	0.4
Humphreys	7.5	92.5	2.1	0.8	0.7	0.0	0.0	2.5
Lawrence	6.7	93.3	1.7	0.3	0.5	0.2	0.4	2.2
Lewis	6.7	93.3	1.8	0.0	1.4	0.0	0.1	2.3
Lincoln	13.2	86.8	7.1	0.2	0.5	0.0	0.0	3.5
Marshall	15.1	84.9	7.6	0.0	0.3	0.0	0.7	5.4
Maury	20.7	79.3	11.5	0.1	0.9	0.0	0.2	5.8
Montgomery	36.7	63.3	19.3	0.5	2.1	0.4	0.4	10.0
Moore	7.4	92.6	2.2	1.6	2.4	0.0	0.0	0.2
Perry	8.1	91.9	2.7	0.2	2.2	0.0	0.0	1.4
Robertson	16.7	83.3	7.2	0.2	0.6	0.1	0.1	6.9
Rutherford	29.2	70.8	14.5	0.2	3.4	0.0	0.1	8.0
Stewart	8.2	91.8	0.9	0.2	0.7	0.4	0.0	3.0
Sumner	15.9	84.1	7.3	0.3	1.4	0.0	0.1	4.9
Williamson	15.4	84.6	4.1	0.1	4.2	0.0	0.1	4.8
Wilson	15.0	85.0	7.1	0.3	1.6	0.0	0.2	4.2

Source: 2019 ACS
[1] Race percentages are provided for those reporting a particular race alone or in combination. Less than 3 percent of the US population reported two or more races in the 2010 Census; thus, these percentages are closely representative of the whole ethnic group population.
[2] This group is calculated separately from the other ethnicities and may include overlap from the other categories, as the USCB does not consider Hispanic or Latino a "race."
Note: Emboldened census block groups represent identified EJ populations as compared with the overall study area percentage.

3.4.1.4.1.2. Low-Income Populations

Table 3.4-14 presents poverty ratios for the counties in the Alternative C EJ study area, along with those for the overall study area and state. While the overall study area has a lower poverty ratio than the state according to the 2019 ACS, 11 of the 24 counties had higher minority percentages than the state. No county had a poverty percentage that was 20 percentage points or more above the study area average (29.3) and/or above 50 percent based on the 2019 ACS Table 3.4-14.

Table 3.4-14. Poverty Rates for the EJ Study Area for Alternative C

Geography	2019 SAIPE Poverty %	2019 ACS Poverty %, Households	2019 ACS Poverty Ratio, Two Times US Threshold **
Study Area	12.2	14.0	29.3
Tennessee	*13.8*	*13.2*	*34.9*
Bedford County	13.9	14.0	40.8
Cheatham County	9.6	9.5	27.1
Coffee County	14.4	13.9	37.4
Davidson County	12.6	13.0	32.9
Dickson County	10.1	12.7	34.0
Franklin County	13.9	15.8	35.6
Giles County	13.4	13.7	35.6
Hickman County	16.3	16.0	42.8
Houston County	17.8	19.2	42.3
Humphreys County	13.1	17.0	36.3
Lawrence County	16.7	16.7	41.5
Lewis County	15.2	19.4	43.4
Lincoln County	12.8	14.2	37.1
Marshall County	13.1	18.9	37.5
Maury County	8.5	18.5	28.3
Montgomery County	12.0	13.5	33.9
Moore County	10.0	10.2	29.5
Perry County	14.4	24.8	49.1
Robertson County	10.5	11.1	29.0
Rutherford County	10.0	10.0	26.8
Stewart County	12.9	13.6	33.2
Sumner County	8.6	8.8	24.1
Williamson County	4.3	4.8	12.1
Wilson County	7.4	7.7	21.2

Source: 2019 SAIPE (USCB 2019), 2019 ACS (USCB 2020)

3.4.1.4.1.3. Limited English Proficiency Populations

Table 3.4-15 presents county counts and percentages for the population aged five years and older who live in LEP households. Davidson and Rutherford counties exceeded the study area-wide county average for numbers of LEP households. Davidson County also had an LEP household percentage that exceeded the overall study area average.

Table 3.4-15. Limited English Proficiency for the EJ Study Area for Alternative C

Geography	Population 5 Years and Over in Limited English Households (County Average)	Percent of Population Age 5 Years and Over in Limited English Households (County Average)
Study Area	2,629	2.8
Middle Tennessee County		
Bedford	1,495	3.1
Cheatham	199	0.5
Coffee	395	0.7
Davidson	41,893	6.1
Dickson	23	0.0
Franklin	189	0.5

Geography	Population 5 Years and Over in Limited English Households (County Average)	Percent of Population Age 5 Years and Over in Limited English Households (County Average)
Giles	192	0.7
Hickman	15	0.1
Houston	20	0.2
Humphreys	11	0.1
Lawrence	354	0.8
Lewis	110	0.9
Lincoln	27	0.1
Marshall	374	1.1
Maury	731	0.8
Montgomery	1,551	0.8
Moore	117	1.8
Perry	26	0.3
Robertson	1,114	1.6
Rutherford	8,652	2.7
Stewart	47	0.4
Sumner	1,474	0.8
Williamson	2,322	1.0
Wilson	1,774	1.3

Source: 2019 ACS (USCB 2020)

The above table indicates that there is the potential for LEP populations to be affected by Alternative C. However, since specific sites have yet to be chosen, additional site-specific analyses at the census block group level are warranted to better define the study areas and need for translation or interpreter services. If Alternative C were to be selected, tiered NEPA analysis would be completed, and the appropriate outreach would be conducted in relation to identified LEP populations, if needed.

3.4.2. Environmental Consequences

This section includes an EJ effects analysis for the No Action Alternative and a discussion of the potential effects to EJ populations based on the effects to other resource areas. Where effects to EJ populations are unique given the particular resource area, those effects are discussed in more detail in the EJ Consideration sections in the subsequent resource area sections of Chapter 3. Where effects to EJ populations are not anticipated, EJ is not discussed in the subsequent Chapter 3 sections; rather, these are summarized in Table 3.4-16. Where effects to EJ populations are less understood due to a lack of geographic detail for the particular alternative or alternative component, these effects are discussed in this section and not included elsewhere.

Table 3.4-16 summarizes the anticipated effects for each resource area, including some beneficial effects.

3.4.2.1. The No Action Alternative

TVA would continue to operate and maintain the two CUF coal-fired units. Employment at CUF would continue to be an option in the labor market area, and contracts associated with CUF operations and maintenance and indirect and induced economic activities would continue to support the regional economy. However, in order for the existing CUF units to remain operational, repairs and maintenance would be necessary in order to maintain reliability. These maintenance costs, along with subsequent environmental compliance

costs to meet requirements under new regulations, may have an adverse effect on ratepayers. Any future rate increases to recoup these costs could affect low-income populations more than other populations; thus, the EJ populations may experience increased economic effects.as compared to non-EJ populations. Low-income populations also have limited ability to participate in energy efficiency programs that could reduce their future power bills, as some costs must be incurred by those participating in energy efficiency programs. TVA works with local power companies to implement programs benefiting low-income homeowners and renters, which may partially offset effects to EJ populations associated with rate increases (see the TVA IRP EIS for more details).

3.4.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Under the Action Alternatives, the coal units at CUF would be retired by 2026 (first unit) and 2028 (second unit) and would transition to the D4 process detailed in Table 2.1-1. Routine plant deliveries would also be discontinued. All previously approved CCR projects would continue to be implemented.

There would be short-term beneficial economic effects to human populations, including EJ populations, from CUF retirement and D4 activities associated with all Action Alternatives, including a temporary increase in employment and income and the purchase of materials, equipment, and services. This increase would be local or regional, depending on where the workers, goods, and services were obtained, and could positively affect EJ populations. Beneficial effects may also be experienced by EJ and other populations from improved air and water quality in response to ceasing of CUF operations. Beneficial water quality effects could have positive effects on aquatic life, including potential subsistence resources for EJ populations, which could in turn have slight beneficial effects to EJ and other populations utilizing these resources.

There could also be minor adverse effects to human populations, including EJ populations, from CUF retirement and D4 activities associated with all Action Alternatives. Due to the loss of direct and indirect employment associated with CUF, competition for employment in other fields in the CUF labor market area, such as manufacturing, educational services, health care, and construction, may increase. Such trends could lead EJ populations and other populations to compete for employment and, potentially, relocate for work or follow recent depopulation trends and permanently relocate to different locations in Tennessee or beyond. These changes may affect familial and community relations among EJ and other populations in the CUF labor market area. Given their particular economic and cultural vulnerabilities, these effects may be amplified for EJ populations.

Effects to air quality due to CUF D4 activities would be short-term, minor, and generally limited to the TVA-owned CUF Reservation, with some chance of affecting a small area outside the CUF Reservation boundary where EJ populations reside. The EJ-qualifying census block groups in these locations have elevated percentages of environmental indicators, including particulate matter and air toxins, as compared with the state, and due to proximity, EJ populations could be affected by fugitive dust emissions and could experience increased (amplified) effects as compared with the non-EJ qualifying block groups farther from the CUF Reservation. Exposure to fugitive dust emissions would be regulated through state regulations that require measures to minimize airborne dust.

If fishing and hunting on the CUF Reservation is temporarily limited or not allowed, this could in turn adversely affect EJ populations and other populations that currently fish and

hunt at the Lake Barkley Recreation Area, portions of which are on the CUF Reservation(USACE 2022a). Likewise, human populations utilizing aquatic life that depend on the heated effluent from CUF may also have slight negative effects due to its retirement. These minimal to minor adverse effects on EJ populations could be amplified due to the likelihood that the reliance on these resources is more critical to or are long-term cultural practices of these low-income and minority populations.

Waste-related effects from CUF D4 activities may occur at selected waste facilities in the area. As these facilities, which are located off the TVA-owned reservation, have not yet been identified and have the potential to be located in EJ areas; therefore, amplified effects to EJ populations from disposing of CUF-related wastes at these facilities are possible.

Transportation effects associated with CUF D4 activities would be concentrated on public roads within a relatively small area around the TVA-owned CUF Reservation, where EJ populations are located, and along the haul routes to waste facilities, which have not yet been identified. Therefore, there would be a minor effect related to increased traffic and driver safety. While they would be minimized as much as feasible, these effects may be amplified for EJ populations depending on the location of these elevated traffic effects. Effects to EJ populations resulting from CUF retirement-related traffic on haul routes to waste facilities is not yet known, as these facilities have not been identified. Cumulative effects to EJ populations are also possible, especially if the D4 and CCR management construction occur at the same time. Given their presence surrounding the CUF Reservation, EJ populations may also experience minor impacts due to potential offsite effects to surface water, utilities, safety, noise, and visual aesthetics.

In sum, as a result of CUF retirement, there would be beneficial effects to EJ populations due to positive effects to water quality, air quality, and aquatic life. There also may be minor adverse effects on EJ populations associated with adverse effects to surface water, air quality, aquatic life, recreation, transportation, utilities, waste, safety, socioeconomics, noise, and visual aesthetics due to D4 activities. These effects would be experienced by both EJ and non-EJ populations; however, given their particular economic and cultural vulnerabilities, these effects may be amplified for EJ populations. Effects to other resource areas associated with CUF retirement and D4 activities, including physical resources, vegetation, wildlife, threatened and endangered species, land use, and cultural resources, would be temporary and minor to minimized or mitigated and/or limited to the demolition boundary within the CUF Reservation. Where effects extend offsite, these would likewise be minor to mitigated and are not anticipated to be amplified for EJ populations due to specific regulatory requirements, such as stakeholder involvement in cultural resources decision-making or the protected status of threatened and endangered species.

3.4.2.3. Alternative A

3.4.2.3.1. Construction and Operation of CC Plant at CUF

There would be beneficial effects to human populations, including EJ populations, from the CC plant. Recreational users would benefit from upgrades to the existing barge unloading area and the boat dock at the CUF Reservation. Construction of the CC plant would also temporarily increase employment in the CUF labor market area and have a minor beneficial effect to area EJ populations. Some slight beneficial effects to human populations, including EJ populations, may also result from displacement of wildlife from the immediate CC plant site to surrounding areas, including potentially hunting areas in the vicinity.

There could also be minor adverse effects to human populations, including EJ populations, from the CC plant. Construction of the CC plant may cause negative effects to current and prospective renters and guests of rental homes and establishments through reduced rental inventory and/or increased prices with the influx of nonresident laborers. This has the potential to result in amplified effects for EJ-qualifying low-income populations, especially in the EJ-qualifying census block group Houston County CT 1203 BG 3, which had higher percentages of renter-occupied housing units than across the county.

Effects to air quality due to the CC plant would be reduced in comparison with existing conditions and minimized through permitting and monitoring. The immediate CUF Reservation vicinity, where fugitive dust and particulate emissions have some likelihood of becoming air borne, is predominantly EJ populations. Further, the EJ-qualifying census block groups had elevated percentages of environmental indicators, including particulate matter and air toxins, as compared with the state (and many nearby census block groups). Therefore, the EJ populations in close proximity could experience increased effects of fugitive dust and air emissions as compared with the non-EJ qualifying block groups farther from CUF. Air and fugitive emissions would be regulated under applicable regulations and air permits.

Given their presence surrounding the proposed CC plant site, EJ populations may also experience minor offsite effects to surface water, waste, safety, noise, and visual aesthetics. While both EJ and non-EJ populations would be subject to these effects, these effects may be amplified for EJ populations due to their economic and cultural vulnerabilities and proximity to the CC plant site.

3.4.2.3.2. Construction and Operation of Natural Gas Pipeline Lateral

The route of the proposed pipeline has been modified to minimize construction activities on residential land. According to TGP's Resource Report 1 (2022a):

> Seven houses and eleven other buildings are located within 50 feet of the edge of the proposed construction workspaces. Construction near residential areas will be conducted in a manner to ensure that all construction activities minimize adverse impacts on adjacent residences and that clean-up is prompt and thorough.

One of the seven houses has an associated "site-specific residential construction plan" associated with it due to being within 25 feet of the pipeline work areas. TGP further states:

> Temporary construction impacts on residential areas may include inconvenience caused by noise and dust generated by construction equipment, personnel, and trenching of roads or driveways; ground disturbance of lawns; removal of trees, landscaped shrubs, or other vegetative screening between residences; potential damage to existing septic systems or wells; and removal of aboveground structures such as fences, sheds, or trailers from the ROW.

Adjacent and nearby properties are largely deciduous forests and contain few residences. The pipeline corridor is located within census block groups that include both minority and low-income populations. Because these census block groups are considered EJ populations, TGP "will continue to work closely with government and community leaders to address concerns of the population" (TGP 2022e).

TGP outreach among EJ populations has been extensive and is ongoing, as demonstrated in their Socioeconomic Resource Report 5 (TGP 2022e; note that reference to Project and Project area are to the pipeline study area):

> TGP has conducted a number of meetings with federal, state, county, and local elected officials in the Project area and the Chamber of Commerce for each county where the Project facilities are located as part of its general community outreach. As noted in that same section of Resource Report 1, *General Project Description*, TGP has conducted two in-person open houses in Vanleer, Dickson County on January 18, 2022, and Erin, Houston County on January 19, 2022, and one virtual open house on January 27, 2022. Notices for these open houses were placed in four local newspapers (Dickson Post, Dickson County Herald, Houston County Herald, and Stewart County Standard). Notices of these open houses were mailed to affected landowners along the route of the proposed pipeline, as well as to elected officials. At these open houses, information about the Project was provided in written and visual formats.
>
> TGP is determining additional activities to address any concerns or issues raised by organizers and community leaders of the identified environmental justice communities, which may include additional meetings in these communities. TGP is also evaluating methods to provide and distribute Project information, including Project information translated into Spanish or other languages, to these communities throughout the certificate, permitting, construction, and restoration phases of the Project. In addition, as part of its ongoing efforts to identify and communicate with environmental justice communities that may be affected by the Project, TGP is evaluating the development of materials describing the Project, anticipated impacts, milestone schedule updates, and public participation opportunities to specifically address the needs and concerns of the identified environmental justice communities.
>
> TGP's communication and involvement with the environment justice communities is ongoing and will continue through the certificate, permitting, construction, and restoration phases of the Project. TGP will continue its engagement of minority and low-income populations in proximity to the proposed Project through meaningful participation and coordination with community leaders and groups within environmental justice communities. TGP plans to take the following steps during the certificate, permitting, construction, and restoration phases of the Project to continue to inform and engage environmental justice communities: (1) beginning in the third quarter 2022, conduct small group discussions (e.g., 5-10 people) with community leaders and organizations in environmental justice communities to discuss the Project and any concerns or issues; (2) beginning in the third quarter 2022, provide formal presentations to groups in the impacted environmental justice communities; (3) distribute Project information to community partners for further distribution within their communities; and (4) translate certain Project materials for distribution within environmental justice communities, as well as portions of the Project website, as discussed in Section 5.6.1.5.

> Construction and operation of the Project would not cause impacts (in terms of air quality, water quality, or noise) that are expected to adversely affect the health or welfare of the environmental justice populations living in the Project area. Nor would the Project generate air emissions at levels constituting either nuisance or human health hazards on those populations. TGP anticipates that the Project will not cause disproportionate air, noise, land use, or visual impacts on the identified environmental justice communities. Further discussion on these topics is provided in Resource Report 1, General Project Description, Resource Report 8, Land Use, Recreation, and Aesthetics, and Resource Report 9, Air and Noise Quality.
>
> While Project construction activities may cause temporary impacts in the Project area, these impacts would be distributed along the length of the entire Project and would not disproportionately affect the identified environmental justice communities. Once the pipeline is operational, it would be buried, and thus would not constitute a visual impact on nearby residences. Operation and maintenance activities for the Project facilities would take place on a periodic basis and would not cause significant negative impacts.

As noted above, and in their reports (TGP 2022e), TGP has addressed and will continue to address concerns identified by EJ populations through engagement with community leaders, stakeholders, and elected officials throughout the FERC pre-filing process and certificate application review process and during the construction of the pipeline. This ongoing process will enable TGP to understand and address the concerns of EJ communities in the pipeline study area. TGP will continue these efforts throughout the certification, permitting, and construction phases of the pipeline (TGP 2022e).

In their EJ analysis, TGP concluded that the proposed pipeline would have minor cumulative impacts on EJ populations. TGP determined that construction and operation of the pipeline would not cause permanent impacts (in terms of air quality, water quality, or noise) that are expected to adversely affect the health or welfare of the EJ populations living in the pipeline area (TGP 2022e). TGP likewise concluded that the pipeline would not generate air emissions at levels constituting either a nuisance or human health hazards on those EJ populations While pipeline construction activities would cause temporary adverse impacts, TGP concluded that these impacts would be distributed along the length of the pipeline corridor and would not affect the identified EJ populations more than non-EJ populations. Operation and maintenance activities for the pipeline facilities would take place on a periodic basis and, per TGP findings, would not cause significant negative impacts on EJ populations.

TVA's analysis draws upon TGP's EJ analysis and provides TVA's independent assessment of potential impacts associated with construction and operation of the natural gas pipeline lateral. The TVA analysis concluded that there would be beneficial effects to human populations, including EJ populations, from the natural gas pipeline lateral due to temporary increases in employment in the area. The TVA analysis also concluded that the natural gas pipeline lateral could result in minor adverse effects to human populations, including EJ populations. Construction of the pipeline may cause negative effects to current and prospective renters and guests of rental homes and establishments through reduced rental inventory and/or increased prices due to the influx of nonresident laborers. This may result in amplified effects for EJ-qualifying low-income populations, especially in EJ-qualifying census block groups with higher percentages of renter-occupied housing units

than the associated county, such as Dickson County CT 602 BG 1 and BG 3 and Houston County CT 1201 BG 2. In Houston County CT 1201 BG 2, these effects may be slightly offset due to the prominence of people in the construction field, which could lead to employment in pipeline construction.

Pipeline construction would have transportation effects that would be temporary, minor, and concentrated on public roads within a relatively small area around the pipeline corridor, where EJ populations are intermixed with non-EJ populations. At least two temporary contractor yards would provide parking for construction staff, contractor management offices, equipment and vehicle staging, and storage of pipe and other materials, and will therefore be activity hubs during construction. Both of the identified contractor yard locations are in EJ areas. While pipeline construction activities would generally be conducted between the hours of 7:00 a.m. to 7:00 p.m., Monday through Saturday, TGP anticipates that certain HDD drilling operations would occur on a 24 hours per day, 7 days per week schedule for approximately 60 days (of the 112-day estimated duration of each HDD) at each of the three HDD locations, all of which are within EJ areas. While they would be minimized by detouring traffic or keeping one lane open, these effects would likely be amplified for EJ populations given the location of these elevated traffic effects.

Safety-related effects due to pipeline construction and operations activities may also be experienced by EJ populations, and some of this would be heightened near high traffic construction areas. Given their proximity to the two identified contractor yards, the Cumberland Meter Station, and major roads along the pipeline corridor, EJ populations have the potential to experience minor safety effects from pipeline construction and operations. Waste-related effects occurring as a result of pipeline construction activities, while minor, would be outside of TVA-owned reservations or at selected waste facilities in the area. The offsite waste facilities have the potential to be located in EJ areas based on the history of the siting of these types of facilities (and the general assumptions that are made in evaluating EJ effects). While utilities-related effects may be experienced by EJ populations in the pipeline corridor during construction and operations for maintenance activities that may involve excavation and repair, these minimal to minor effects may be amplified for EJ populations given their prominence in the vicinity and their cultural and economic vulnerabilities.

Pipeline construction activities would also increase the noise and visual effects on local populations, both EJ and non-EJ. Given the prominence of EJ populations in the pipeline corridor, these effects would generally be experienced by EJ populations more than other populations. Further, some of the loudest and most visually intrusive activities and components are located in EJ areas. Noisy activities and components in EJ areas include the HDD locations, where pipeline would be installed under certain streams during construction, and the Cumberland Meter Station, which would operate continuously when gas is flowing through the pipeline. Due to the high level of noise generated by the operation of these facilities, TGP would implement noise mitigation measures, including temporarily relocating the affected residents during short-term noise-making activities, and therefore, impacts to EJ populations would be minimized and mitigated.

Visually intrusive activities and components in EJ areas that would not be minimized or mitigated include the construction of the mainline valve (MLV), which would result in some visual impacts to nearby residences and passing traffic on Little Bartons Creek Road, on the border of EJ and non-EJ areas. The Cumberland Meter Station would be constructed at the CC plant site on the CUF Reservation within EJ areas but would largely be out of sight

from nearby residences and public roads. The loss of forested areas in the pipeline corridor would result in a permanent visual impact for human communities, including EJ populations, with greater effects where the cleared forest provided a visual screen at nearby residences. These effects may be amplified for EJ populations given that approximately 72 percent of the existing forested area is within areas designated as EJ areas and much of that would need to be removed for the pipeline.

Effects to prime farmland resources due to construction of the natural gas pipeline lateral may also have temporary, minor adverse effects on populations that currently farm the corridor where the pipeline would be constructed. Such effects would occur where farming populations and prime farmland soils co-exist. These effects may be amplified for farming EJ populations since approximately 71 percent of the prime farmland or farmland of local importance are in EJ areas, and these low-income and minority populations may be more vulnerable to temporary farmland loss. Long-term effects to land use associated with the pipeline corridor could in turn adversely affect EJ populations due to their prominence in the corridor.

Effects to aquatic life resulting from the natural gas pipeline lateral would occur in areas with higher percentages of EJ populations than non-EJ populations (seven out of 10 census block groups are low-income EJ populations in the pipeline lateral EJ study area). If indirect effects to aquatic life occur, these could in turn affect EJ populations that currently fish the affected waters. Fishing activities are known to occur within five miles of the Lake Barkley Recreation Area or Cross Creeks National Wildlife Refuge (see Section 3.9 for more details on these areas; USACE 2022a and USFWS 2022a). While fishing activities likely occur among both EJ and non-EJ populations, the effects could be amplified for low-income and minority populations due to the likelihood of their reliance on these recreational resources for long-term cultural practices..

While they would be minor, minimized, or mitigated through CWA 404, 401, and 402 (NPDES) permitting, effects to streams due to the pipeline may be amplified for EJ populations since approximately 63 percent of affected streams are within EJ areas. Further, these populations may be more vulnerable to the effects from temporary 404/401 impact activities. While certain actions would be taken to minimize risks, effects to floodplains due to construction of the natural gas pipeline lateral would occur where human populations and floodplains co-exist. These effects may be amplified for EJ populations since approximately 57 percent of the floodplains located in the pipeline corridor are in EJ areas. Further, these low-income and minority populations may be more vulnerable to temporary effects that cause minor flood loss or effects to human safety, health, and welfare.

As much as feasible, TGP would locate the pipeline parallel and adjacent to existing TVA transmission lines, which would generally minimize effects to vegetation and other resource areas. The greatest impact of the pipeline on vegetation would be from the clearing of forested areas. In areas that are currently used by EJ populations, potentially including forested areas, there is potential for amplified effects to EJ populations. This is because approximately 72 percent of existing forested area is within EJ areas, and much of that would need to be removed for the pipeline. This clearing would also impact habitats and wildlife through temporary and permanent displacement from portions of the corridor. These effects would occur in areas where EJ populations are prominent, as seven of the 10 census block groups are EJ populations, and could result in amplified effects for EJ populations that currently utilize wildlife from these areas. While displacement could result

in more wildlife in nearby areas, the benefits to human populations, including EJ populations, are anticipated to be negligible.

Lastly, there is potential that air quality effects could be more pronounced in EJ-qualifying Dickson County CT 602 BG 2 within the pipeline corridor, where EJScreen indicates increased percentiles for particulate matter and air toxics associated with cancer risk and respiratory issues in comparison with the state.

3.4.2.3.3. Summary of Alternative A

Under Alternative A, the CUF coal facilities would be retired and demolished, as described in Section 2.1.3.1. The existing switchyard at CUF would be maintained temporarily for use in future operations associated with a proposed CC plant, and a new switchyard will be built with the CC plant. The CC plant would be constructed on the CUF Reservation in Stewart County, Tennessee. The new CC plant would require construction of approximately 32 miles of new 30-inch-diameter natural gas pipeline lateral and associated gas system infrastructure in Stewart, Houston, and Dickson counties, Tennessee.

Beneficial and adverse effects to EJ populations resulting from the effects of Alternative A to other resource areas are summarized below and in Table 3.4-16. Effects to resource areas not discussed in the sections below would be temporary and minor to minimized or mitigated and generally limited to the immediate disturbance footprints (either the CC plant location or the pipeline corridor). Where effects go outside of these footprints, these would likewise be minor to mitigated and are not anticipated to be amplified for EJ populations due to specific regulatory requirements, such as stakeholder involvement in cultural resources decision-making or the protected status of threatened and endangered species. While these minor effects would likely be experienced by both EJ and non-EJ communities, those effects may be amplified for EJ populations due to their proximity to the effects and their economic and cultural vulnerabilities.

3.4.2.4. Alternative B

Under Alternative B, TVA would replace the power generated by one of the units at the existing CUF plant with CT facilities, as described in Section 2.1.4. The CT facilities would be constructed on the JCT and Gleason Reservations in Humphreys and Weakley counties, Tennessee, respectively. The new CT facilities would require construction of approximately 40 miles of new 500-kV TL from the existing Weakley 500-kV TL to a new station on the Marshall-Cumberland 500-kV TL.

Beneficial and adverse effects to EJ populations resulting from the effects of Alternative B to other resource areas are summarized below and in Table 3.4-16. Effects to resources areas not discussed in this section would be temporary and minimized to minor and generally limited to the reservation boundaries of Gleason and JCT. Where effects go offsite, these would likewise be minor and are not anticipated to be amplified for EJ populations due to their distance from the anticipated effects or because of specific regulatory requirements, such as stakeholder involvement in cultural resources decision-making or the protected status of threatened and endangered species.

3.4.2.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Construction and operation of the CT facilities associated with Alternative B would increase employment in the JCT labor market area, which could have minor beneficial effects on EJ populations. Minority EJ populations are present in the immediate vicinity of the JCT Reservation, and in total, six of the 19 census block groups within the JCT Reservation

labor market area are low-income and/or minority EJ populations (Figure 3.4-5 and Figure 3.4-6). The addition of wildlife into surrounding suitable habitat may also have a negligible beneficial effect on EJ and other populations that utilize those habitats for subsistence and other purposes, such as in nearby Camden Wildlife Management Area and Tennessee National Wildlife Refuge.

There could also be minor adverse effects to human populations, including EJ populations, from the construction of the CT facilities at JCT. Amplified effects to EJ populations may result due to recreation, air quality, transportation, waste, and visual and noise impacts, as described below.

Effects on air quality from construction of the CT facilities would be short-term, localized, and minor and would affect EJ and non-EJ populations given their proximity to the JCT. However, there is potential that these effects could be more pronounced in EJ-qualifying Humphreys County CT 1305 BG 1. According to EJScreen, this census block group has elevated percentiles for particulate matter and air toxics associated with cancer risk and respiratory issues as compared with the state.

Transportation effects would be temporary, minor, and concentrated on public roads within a relatively small area around the TVA-owned JCT Reservation. Similarly, waste-related effects would be temporary or reduced in comparison to existing conditions, mitigated, and generally limited to the immediate TVA-owned reservation. Since the census block groups immediately adjacent to JCT are qualifying low-income and minority populations, amplified effects to EJ populations are possible.

Visual and noise effects due to the CT facilities would be minor and generally limited to the immediate TVA-owned JCT reservation or nearby vicinity. However, because EJ populations are present near JCT, these short-term negative conditions could result in amplified effects for EJ populations.

3.4.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

Construction and operation of the CT facilities associated with Alternative B would increase employment in the Gleason labor market areas, which could have minor beneficial effects on EJ populations. While there are no EJ populations in the immediate vicinity of the Gleason Reservation, four of the 15 census block groups within the labor market area are low-income or minority EJ populations. The addition of wildlife into surrounding suitable habitat may also have a negligible beneficial effect on EJ and other populations that utilize those habitats for subsistence and other purposes.

The human populations within the area surrounding the Gleason Reservation, where effects would generally occur, are not considered EJ populations. Therefore, adverse impacts to EJ populations would likely not occur, or where they may occur, would be negligible.

3.4.2.4.3. Transmission and Other Components

While not anticipated to be significant based on a review of EJ effects caused by past TVA transmission line upgrade efforts, because the locations of the transmission line upgrades have not yet been identified and the EJ populations are, therefore, not known, beneficial and amplified effects to EJ populations associated with transmission upgrades would be assessed in future environmental reviews.

3.4.2.5. Alternative C

TVA anticipates that a portion of the solar facilities proposed under Alternative C would be located in the Middle Tennessee region in order to offset transmission system upgrades that may be required following the retirement of CUF. Power from these facilities would typically be delivered by direct connection to TVA's transmission system or via interconnections with local power companies that distribute power from TVA.

Generalized beneficial effects and any amplified adverse effects to EJ populations resulting from the effects of Alternative C to other resource areas are summarized below and in Table 3.4-16. Focused, site-specific analyses for each proposed solar site would be needed to determine whether the specific project effects would be amplified for EJ populations.

3.4.2.5.1. Construction and Operation of Solar and Storage Facilities

As specific sites have not yet been determined for evaluation under this alternative, typical EJ effects associated with solar facilities are listed under Section 3.2 and cannot be determined on a location-specific basis. In general, the main effects of consideration for EJ populations would likely result from construction activities, operations, and considerations of greenhouse gases and climate change under Alternative C. Solar and storage facility construction activities are expected to have short-term, localized, and minor effects on air quality and, along with operation activities, no appreciable direct or indirect effect on regional climate change. Additionally, the solar and storage facility operations are expected to have long-term, moderate, beneficial effects on air quality and on regional climate change in comparison to existing conditions.

The addition of wildlife into surrounding suitable habitat may have a slight beneficial effect to EJ and other populations that utilize those habitats for subsistence and other purposes. Construction of the solar facilities associated with Alternative C would also temporarily increase employment in portions of Middle Tennessee. These socioeconomic effects could potentially have a minor beneficial effect to EJ populations in the areas selected for the solar facilities.

While no solar facilities previously developed by TVA had amplified adverse effects on EJ populations, if effects were to occur, they would likely be associated with land use and vegetation changes; recreational areas; water and wildlife effects; construction traffic, noise, and safety issues; and short-term and long-term visual effects, and these could be exacerbated by cumulative effects. However, based on the number of solar sites that would be needed to replace generation at CUF, there is potential for moderate effects to land use through conversion of agricultural land, particularly cropland, to developed land with potential for later restoration of agricultural use. While these land use conversions are not expected to have amplified effects on EJ populations, depending on the number and location of solar facilities, individual EJ reviews would be completed for each solar and storage facility associated with Alternative C as it is proposed.

3.4.2.5.2. Transmission and Other Components

In general, transmission upgrades associated with Alternative C are anticipated to have the same beneficial and amplified effects as those detailed in Section 3.4.2.5.1.

Table 3.4-16. Summary of Environmental Justice Effects by Alternative and Resource Area

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
Physical Characteristics	Effects to physical resources due to CUF retirement and D4 activities would be minor and limited to the TVA-owned CUF Reservation, where no populations are present. Therefore, no effects are anticipated on EJ populations.	Effects to physical resources as a result of the CC plant would be minor and limited to the TVA-owned CUF Reservation, where no populations are present. Therefore, no effects are anticipated on EJ populations. Minor geologic hazards, such as those presented by karst features, are distributed across the pipeline corridor, would be minimized as much as feasible, and are not anticipated to pose a particular risk to EJ populations. Runoff and erosion may temporarily increase due to pipeline construction activities, but these effects would be experienced by both EJ and other populations across the pipeline corridor; as such, these effects are not anticipated to be amplified for EJ populations. Effects to prime farmland resources as a result of construction of the natural gas pipeline lateral may have temporary, minor adverse effects on populations that currently farm the corridor where the pipeline would be constructed. Such effects would occur where farming populations and prime farmland soils co-exist. These effects may be amplified for farming EJ populations since approximately 71 percent of the prime farmland or farmland of local importance are in EJ areas, and these low-income and minority populations may be more vulnerable to temporary farmland loss.	Effects to geology and soil resources due to the CT facilities would be minor and limited to the TVA-owned reservations, where no populations are present. Therefore, no effects are anticipated on EJ populations. Temporary or permanent loss of prime farmland resources as a result of construction of the transmission line activities, if new ROW is required, may have temporary or permanent effects on populations that currently farm the sites where the facilities would be constructed. Such effects would occur where farming populations and prime farmland soils co-exist. Whether these effects may be amplified for EJ populations would be more fully evaluated once the route and the particular activities are better known. Floodplains effects at the Gleason Reservation would be minor and minimized, and EJ populations are well removed from the immediate Gleason vicinity.	The construction and operation of 3,000 MW of solar and 1,700 MW of battery storage, largely at sites within the Middle Tennessee region, could result in temporary moderate effects to prime farmland. Following decommissioning of the solar facilities the majority of the sites could be returned to agricultural use with little reduction in soil productivity or affect to prime farmland/farmland of statewide importance. Effects to geology and soil resources for individual solar and storage facilities would likely be minor and limited to the project sites and transmission line corridors. Therefore, effects to EJ populations are not anticipated. Temporary or permanent loss of prime farmland resources as a result of construction of the solar facilities and the transmission line activities, if new ROW is required, may have temporary effects on populations that currently farm the sites where the facilities would be constructed. While not anticipated to be significant, potential effects on EJ populations would be evaluated for individual solar and storage facilities. Floodplains effects on EJ populations are anticipated to be minor and minimized; however, whether these effects may be amplified for EJ populations would be evaluated for individual solar and storage facilities.

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
		Effects to floodplains due to construction of the natural gas pipeline lateral may have temporary, minor adverse effects on human populations where the pipeline would be constructed. While certain actions would be taken to minimize risks, such effects would occur where human populations and floodplains co-exist. These effects may be amplified for EJ populations since approximately 57 percent of the floodplains are in EJ areas, and these low-income and minority populations may be more vulnerable to temporary effects that cause minor flood loss or effects to human safety, health, and welfare.		
Water Resources	Effects to surface water due to CUF retirement and D4 activities would be minor and minimized and largely limited to the TVA-owned CUF Reservation, where no populations are present. For effects that may be experienced offsite, these could have a minor adverse effect on EJ populations given their prominence in the vicinity. Beneficial effects from improved water quality in response to ceasing of CUF operations are anticipated for human populations, including EJ populations, in the vicinity.	Effects to surface water and wetlands due to the CC plant and pipeline would be minor, minimized, or mitigated through CWA 404, 401, and 402 (NPDES) permitting. For the CC plant, there would be no effect to wetlands. Surface water effects would be largely limited to the TVA-owned CUF Reservation, where no populations are present. For effects that may be experienced offsite, there is the potential for amplified effects on EJ populations given their prominence in the vicinity. For the pipeline, these effects would be largely limited to the immediate pipeline corridor, where both EJ and non-EJ populations are present. These potential effects may be amplified for EJ populations since approximately 63 percent of affected streams are within EJ areas. Further, these populations may be more	Effects to water resources due to the CT facilities would be minor, minimized, or mitigated through CWA 404, 401, and 402 (NPDES) permitting, and largely limited to the TVA-owned reservations, where no populations are present. If effects to the Tennessee River occur due to cooling water for the CT facilities at JCT, these could in turn affect EJ populations that utilize the river for subsistence or other purposes, such as in nearby Camden Wildlife Management Area and Tennessee National Wildlife Refuge. There is the potential for amplified effects on EJ populations due to the likelihood that reliance on these resources is more critical to or are long-term cultural practices of low-income and minority populations. Effects on EJ populations associated with the transmission line could occur	Effects to water resources would be minor, minimized, or mitigated through CWA 404, 401, and 402 (NPDES) permitting, and largely limited to project sites and transmission line corridors. Cumulative wetland effects may occur but will be minimized through proper siting and the use of BMPs. These effects may in turn affect EJ populations where the populations and wetlands co-exist. Overall, while not anticipated to be significant, effects on EJ populations related to water resource effects would be evaluated for individual solar and storage facilities.

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
		vulnerable to the effects from temporary 404/401 impact activities. Significant effects to groundwater due to the pipeline are not anticipated or would be minimized or mitigated through best management practices. TGP would conduct construction activities in accordance with the FERC Plan to minimize potential impacts to groundwater in the vicinity of the pipeline. Prior to construction, TGP would seek landowner permission to conduct pre- and post-construction monitoring of water quality and yield for all wells within the appropriate buffer zones using a qualified, independent contractor to identify and mitigate any unlikely impacts on groundwater quality and quantity. As such, no effects on EJ populations are anticipated.	where water resources and EJ populations co-exist.	
Air Quality and GHGs	Effects to air quality would be short-term, minor, and generally limited to the TVA-owned CUF Reservation, with some chance of affecting a small area outside the CUF Reservation boundary, where EJ populations reside. The EJ-qualifying census block groups had elevated percentages of environmental indicators, including particulate matter and air toxins, as compared with the state (and many nearby census block groups). Due to the elevated environmental indicators and due to proximity, certain EJ populations would likely be affected by fugitive dust emissions and would experience increased (amplified) effects as compared with the non-EJ qualifying block groups farther from CUF. Minor positive effects to EJ and other	Effects to air quality due to the CC plant would be reduced in comparison with existing conditions and minimized through permitting and monitoring. The immediate CUF Reservation vicinity, where fugitive dust and particulate emissions have some likelihood of becoming air borne, is predominantly EJ populations. Further, the EJ-qualifying census block groups had elevated percentages of environmental indicators, including particulate matter and air toxins, as compared with the state (and many nearby census block groups). Due to these higher environmental indicators and due to proximity, EJ populations would likely be affected by fugitive dust emissions and would experience increased effects as compared with	Effects to air quality would generally be limited to the immediate vicinity of the TVA-owned reservations, the transmission line corridor, and nearby public roads. While there are no EJ populations or residences in the immediate vicinity of the Gleason Reservation and no residences in the immediate vicinity of the JCT, EJ populations are present in the census block group that encompasses JCT (qualifying low-income populations) and in the census block group immediately to the west of JCT (qualifying minority populations), across the Tennessee River. Effects on air quality from construction of the CT facilities would be short-term, localized, and minor and would affect EJ and non-EJ	Effects to air quality are anticipated to be minimal to negligible or mitigated and limited to the immediate project sites and transmission line corridors. The main effects of consideration for EJ populations would likely result from construction activities, operations, and considerations of greenhouse gases and climate change. Solar and storage facility construction activities are expected to have short-term, localized, and minor effects on air quality and, along with operation activities, no appreciable direct or indirect effect on regional climate change. Additionally, the solar and storage facility operations are expected to have long-term, moderate, beneficial effects on air quality and on regional climate change in comparison to existing

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
	populations utilizing areas near or on the CUF Reservation may occur due to beneficial changes to local air quality from CUF retirement.	the non-EJ qualifying block groups farther from CUF. Effects to air quality due to the pipeline would be minor and generally limited to the immediate pipeline corridor and construction area, and fugitive emission releases of gases are expected to be minimal compared with existing conditions. The immediate pipeline corridor vicinity, where fugitive dust, particulate, and natural gas emissions have some but low likelihood of occurring, has varying percentages of both EJ and non-EJ populations, with the majority consisting of EJ populations. However, these emissions are expected to be minor and widely distributed over the entire 32-mile pipeline; therefore, EJ and non-EJ populations would both experience these effects. There is potential that air quality effects could be amplified in EJ-qualifying Dickson County CT 602 BG 2 within the pipeline corridor, where EJScreen indicates increased percentiles for particulate matter and air toxics associated with cancer risk and respiratory issues in comparison with the state. This EJ area may experience amplified and adverse human health or environmental effects.	populations given their proximity to the JCT. However, there is potential that these effects could be more pronounced in EJ-qualifying Humphreys County CT 1305 BG 1. According to EJScreen, this census block group has elevated percentiles for particulate matter and air toxics associated with cancer risk and respiratory issues as compared with the state. Due to proximity and the elevated background risks, this EJ area has the potential to experience amplified and adverse human health or environmental effects. Cumulative effects from Alternative B and other projects may result in minor, temporary adverse effects to air quality during construction that would be mitigated using BMPs. EJ populations, like the non-EJ populations also nearby, may experience cumulative effects from implementation of Alternative B, and in EJ-qualifying Humphreys County CT 1305 BG 1, as discussed above, these effects could be more pronounced, per the above. Air quality effects from transmission line construction and upgrade activities are expected to be short-term, minimal, and widely distributed over the study area. Thus, minimal to no effects are anticipated on EJ populations.	conditions and are more favorable than Alternatives A or B. Full EJ considerations would be made for each solar and storage facility associated with Alternative C as it is proposed.
Biological Environment	Effects to vegetation and wildlife would be minor and limited to the TVA-owned CUF Reservation, where no populations are present. Thus, no adverse effects would occur to EJ populations. While minor	Effects to vegetation due to the CC plant would be minor and limited to the reservation boundaries, where no populations are settled. Thus, no effects would occur to EJ populations.	Effects to vegetation would be minor and limited to the TVA-owned reservations, where no populations are present. Thus, no effects would occur to EJ populations.	Impacts to EJ populations associated with vegetation effects would primarily be associated with the direct removal of forested areas and the removal of existing vegetation, generally, as a result of cumulative

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
	displacement of wildlife could result in more wildlife in nearby recreation areas and wildlife refuges, the benefits to human populations would be negligible. Effects to aquatic life, including potential subsistence resources for EJ populations, due to CUF retirement and D4 activities would be minor to minimized or mitigated and generally reduced in comparison to existing conditions. Thus, overall, there may be slight beneficial effects to human populations utilizing these resources, while those utilizing aquatic life that depend on the heated effluent may have slight negative effects. These minor to minimal adverse effects on EJ populations could be amplified due to the likelihood that the reliance on these resources is more critical to or are long-term cultural practices of these low-income and minority populations. Effects to threatened and endangered species that would occur as a result of CUF D4 activities are not anticipated to have amplified human health or environmental effects on EJ populations in the CUF Reservation EJ study area. While the CUF Reservation is generally surrounded by EJ populations, these effects would be minimized or mitigated as required due to the protected status of these species and would not be expected to lead to effects to human populations, including EJ populations.	As much as feasible, TGP would locate the pipeline parallel and adjacent to existing TVA transmission lines, which would generally minimize effects. The greatest impact of the pipeline on vegetation construction would be from the clearing of forested areas. In areas that are currently used by EJ populations, potentially including the forested areas (72 percent of the forested acres in the pipeline corridor overlap with EJ areas), there may be amplified effects on EJ populations. Effects to wildlife that would result from the CC plant would result in negligible beneficial effects to human populations due to displacement of wildlife from the CC plant site. Effects to wildlife from the proposed natural gas pipeline lateral would be minor, while outside of TVA-owned reservations. As much as feasible, TGP would locate the natural gas pipeline generally parallel and adjacent to existing electric transmission lines owned and operated by TVA, which would generally minimize effects to wildlife. However, habitats would be altered and wildlife would be displaced temporarily and permanently from portions of the corridor. These effects would occur in areas where EJ populations are prominent, as seven of the 10 census block groups are EJ populations, and could result in amplified effects for EJ populations that currently utilize wildlife from these areas. While displacement could result in more wildlife in nearby areas, the benefits to human	Effects to vegetation occurring as a result of transmission line activities, while still minor, would be outside of TVA-owned reservations, where effects would occur to EJ and non-EJ populations, alike. Whether these effects would be amplified for EJ populations would be evaluated once the route and the particular activities are better known. The addition of wildlife into surrounding suitable habitat may have a negligible beneficial effect on EJ and other populations that utilize those habitats for subsistence and other purposes, such as in nearby Camden Wildlife Management Area and Tennessee National Wildlife Refuge. Effects to threatened and endangered species would be minimized or mitigated as required due to the protected status of these species and would not be expected to lead to indirect or amplified effects on EJ populations.	effects These effects would be minor and generally limited to the immediate project sites and transmission line corridors. The addition of wildlife into surrounding suitable habitat may be beneficial to EJ and other populations that utilize those habitats for subsistence and other purposes. Effects to threatened and endangered species would be minimized or mitigated as required due to the protected status of these species and would not be expected to lead to indirect or amplified effects on EJ populations. While not anticipated to be significant, these effects on EJ populations would be more fully evaluated for individual solar and storage facilities.

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
		populations are anticipated to be negligible. Effects to aquatic life as a result of the natural gas pipeline lateral are in areas with higher percentages EJ populations than non-EJ populations (seven out of 10 census block groups are low-income EJ populations in the pipeline lateral EJ study area). If indirect effects to aquatic life occur, these could in turn affect EJ populations that currently fish the affected waters. Such activities are known to occur within five miles of the Lake Barkley Recreation Area or Cross Creeks National Wildlife Refuge (see Section 3.9 for more details on these areas; USACE 2022a and USFWS 2022a). While such activities are likely among both EJ and non-EJ populations, the effects could be amplified for low-income and minority populations due to the potential for greater reliance by the EJ communities on subsistence resources. Effects to threatened and endangered species that would occur as a result of the proposed CC plant, transmission line activities, and natural gas pipeline lateral are not anticipated to have amplified human health or environmental effects on EJ populations in the CUF Reservation and pipeline lateral corridor EJ study areas. While the CUF Reservation has EJ populations in the vicinity, these effects would be minimized or mitigated as required due to the protected status of these species and would not be expected to lead to effects to human populations.		

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
Natural Areas, Parks, and Recreation	If fishing and hunting on the CUF Reservation is temporarily limited or not allowed, this could in turn adversely affect EJ populations and other populations that currently fish and hunt at the Lake Barkley Recreation, portions of which are onsite on the CUF Reservation (USACE 2022a). These effects on EJ populations may be amplified due to the likelihood that the reliance on these recreational resources is more critical to or are long-term cultural practices of these low-income and minority populations.	If temporary closure of the Lake Barkley Recreation Area is necessary during construction of the CC plant, this could in turn affect EJ populations and other populations that currently utilize the recreation area. These effects may be amplified for EJ populations due to the likelihood that the reliance on these recreational resources is more critical to or are long-term cultural practices of these low-income and minority populations. Completion of the upgrades to the existing barge unloading area (boat dock) will have beneficial effects for recreational users, including EJ populations.	If long-term effects occur to recreational activities within the Kentucky Reservoir, which is partially within the boundaries of the proposed CT plant, this could in turn adversely affect EJ populations and other populations that currently utilize the recreation area. These effects may be amplified for EJ populations due to the likelihood that the reliance on these recreational resources is more critical to or are long-term cultural practices of these low-income and minority populations. While not anticipated to be significant, recreation-related effects on EJ populations associated with the transmission line would be evaluated once the route and the particular activities are better known.	The main impact to EJ qualifying populations may be attributed to the removal of forested areas, thereby removing them from hunting use. While not anticipated to be significant, recreation-related effects on EJ populations would be evaluated for individual solar and storage facilities.
Land Use	Land use effects would be limited to the CUF Reservation boundary; therefore, no effects on EJ populations.	Long-term effects to land use associated with the pipeline corridor could in turn adversely affect EJ populations. As the majority of the corridor falls within EJ areas, these effects may be amplified for EJ populations. Potential temporary impacts to 49 acres and permanent impacts to 147 acres of prime farmland; 56 of those acres are permanent impacts associated with the CC plant, and 91 acres of permanent habitat conversion associated with TL upgrades. Effects from prime farmland and forested area impacts on EJ populations are evaluated in the Geology, Soils, and Prime Farmland and Vegetation sections.	Long-term adverse effects associated with changes in land use due to proposed 40-mile transmission line; however, areas currently in pasture or agricultural uses could be returned to former condition. These effects would not be amplified for EJ populations. JCT: Minimal to negligible direct effects to approximately 10.1 acres of previously disturbed and developed prime farmland. Gleason: Minimal to negligible direct effects to approximately 15.0 acres of previously disturbed and developed prime farmland. Effects from prime farmland and forested area impacts on EJ populations are evaluated in the	Potential for moderate adverse effects to land use through conversion of agricultural land, particularly cropland, to developed land with potential for later restoration of agricultural use. Effects to EJ populations may occur and, in future analyses, some solar facilities may be found to have amplified effects on EJ populations. Temporary to permanent moderate direct effects from loss of on-site prime farmland soils for a large portion of the approximately 21,900 acres of solar facilities and between 425 and 638 acres required for battery storage. Effects from prime farmland and forested area impacts on EJ populations are evaluated in the

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
			Geology, Soils, and Prime Farmland and Vegetation sections.	Geology, Soils, and Prime Farmland and Vegetation sections.
Transportation	Transportation effects would be temporary, minor, and concentrated on public roads within a relatively small area around the TVA-owned CUF Reservation, where EJ populations are prominent, and along the haul routes to waste facilities, which have not yet been identified. Therefore, there would be a minor effect related to increased traffic and driver safety. While they would be minimized as much as feasible, these effects could likely be greater on EJ populations given the location of these elevated traffic effects. Effects to EJ populations resulting from CUF retirement-related traffic on haul routes to waste facilities is not yet known, as these facilities have not been identified. Cumulative effects to EJ populations may occur, especially if the D4 and CCR management construction occur at the same time.	Transportation effects would be temporary, minor, and concentrated on public roads within a relatively small area around the TVA-owned CUF Reservation, where EJ populations are prominent, and the pipeline corridor, where EJ populations are intermixed with non-EJ populations. At least two temporary contractor yards, both of which are in EJ areas, would be activity hubs during construction. TGP anticipates that certain HDD drilling operations would occur on a 24 hours per day, 7 days per week schedule for approximately 60 days (of the 112-day estimated duration of each HDD) at each of the three HDD locations, all of which are within EJ areas. Given that the more elevated traffic activities associated with Alternative A would be in EJ areas, these minor, temporary effects may become amplified for EJ populations.	Transportation effects would be temporary, minor, and concentrated on public roads within a relatively small area around the TVA-owned JCT and Gleason Reservations and transmission lines. These effects would likely not be amplified for EJ populations in the vicinity of the Gleason Reservation. However, since the census block groups immediately adjacent to JCT are qualifying low-income and minority populations, those EJ populations may experience amplified effects. Transportation-related effects on EJ populations associated with the transmission line would be evaluated once the route and the particular activities are better known.	Transportation effects would be temporary, minor, and concentrated on public roads within a relatively small area around the project sites and transmission line activities. Whether or not these effects would be amplified for EJ populations would be evaluated for individual solar and storage facilities.

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
Utilities	Short-term outages would be minor and would occur in the immediate vicinity of the TVA-owned CUF Reservation, where EJ populations are prominent, and the effects of outages could be greater on these EJ populations.	CC plant-related effects to utilities would be reduced in comparison to existing conditions and minor, with effects occurring on a TVA-owned reservation, where no populations exist. While utilities-related effects may be experienced by EJ populations in the pipeline corridor, effects are anticipated to be limited to construction, except for maintenance activities that may involve excavation and repair. These minimal to minor potential effects may be amplified for EJ populations given their prominence in the vicinity.	For the construction and operation of CT plants at the JCT and Gleason Reservations, no adverse effects and no cumulative effects to existing utilities would occur. Therefore, there would be no effect on EJ populations. Utility effects from transmission line construction and upgrade activities are expected to result in short-term and minor effects. Whether or not these effects would be amplified for EJ populations would be evaluated once the route and the particular activities are better known.	Effects to utilities would be minor, with some service interruptions possible, and minimized or mitigation and would be anticipated to be the same for all human populations utilizing the affected utility resources. Whether or not these effects would be amplified for EJ populations would be evaluated for individual solar and storage facilities .

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
Cultural Resources	Cultural resources-related effects associated with CUF coal facility retirement and D4 activities would be avoided, minimized, or mitigated through implementation of cultural resources survey and NHPA consultation with Native American tribes and interested stakeholders, which could include other EJ populations. Therefore, they are not anticipated to result in adverse or amplified effects on EJ populations.	Cultural resources-related effects associated with the CC plant, pipeline, and transmission activities would be avoided, minimized, or mitigated through implementation of cultural resources survey and NHPA consultation with Native American tribes and interested stakeholders, which could include other EJ populations. Therefore, they are not anticipated to result in adverse or amplified effects on EJ populations.	Cultural resources-related effects associated with the CT facilities would be avoided, minimized, or mitigated through implementation of cultural resources survey and NHPA consultation with Native American tribes and interested stakeholders, which could include other EJ populations. Therefore, they are not anticipated to result in adverse or amplified effects on EJ populations. However, cultural resources-related effects on EJ populations associated with the transmission line would be more fully evaluated once the route and the particular activities are better known.	Cultural resources-related effects would be avoided, minimized, or mitigated through implementation of cultural resources survey and NHPA consultation with Native American tribes and interested stakeholders, which could include other EJ populations. Therefore, they are not anticipated to result in adverse or amplified effects on EJ populations. However, these effects on EJ populations would be more fully evaluated for individual solar and storage facilities.
Solid and Hazardous Waste	Waste-related effects occurring as a result of CUF retirement and D4 activities would occur on or near the TVA-owned reservation or at selected waste facilities in the e area. Most of the deconstruction materials would be transported by truck and train off site for recycling and disposal at approved landfills. As EJ populations are prominent in segments of the CUF vicinity and the offsite waste facilities have the potential to be located in EJ areas, per the history of the siting of these type facilities (and the general assumptions that are made in evaluating EJ effects), EJ populations may experience greater impacts than non-EJ populations.	Waste-related effects related to the CC plant construction would be temporary and mitigated, with most effects occurring on or near a TVA-owned reservation, where EJ populations are prominent. Due to the proximity to EJ populations, those populations may experience amplified effects. Waste-related effects due to the pipeline activities, while still minor, would be outside of TVA-owned reservations or at selected waste facilities in the area. As the offsite facilities have the potential to be located in EJ areas, per the history of the siting of these type facilities, EJ populations may experience amplified effects.	Waste-related effects would be temporary or reduced in comparison to existing conditions, mitigated, and generally limited to the immediate TVA-owned reservations and transmission line corridor. These effects would likely not be amplified for EJ populations in the vicinity of the Gleason Reservation. However, since the census block groups immediately adjacent to JCT are qualifying low-income and minority populations, the potential exists for amplified effects on those EJ populations. Waste-related effects on EJ populations associated with the transmission line would be further evaluated once the route and the particular activities are better known.	Waste-related effects would be temporary, mitigated, and generally limited to the immediate project sites and transmission line corridors and generally the same for EJ populations and other populations in the vicinity. However, to determine amplified effects for a given solar facility, EJ effects analyses would occur for each solar facility and transmission line activity.

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
Safety	Safety-related effects from CUF coal facility retirement and D4 activities would occur on the CUF Reservation, where no populations are present, and in the vicinity, where high traffic concentration would occur. Given their proximity to the D4 activity areas and associated traffic concentrations, EJ populations may experience amplified safety effects from CUF retirement.	Safety-related effects due to the CC plant and pipeline may be experienced by EJ populations, and some of these effects would be heightened near high traffic construction areas. Given their proximity to the two identified contractor yards, the Cumberland Meter Station and major roads along the pipeline corridor and in the CC plant vicinity, EJ populations may experience amplified safety effects.	Safety-related effects due to the CT facilities would generally apply to on-site workers and not the general public, these effects would occur where no EJ populations reside. Safety-related effects from transmission line construction and upgrade activities are expected to be short-term and minimal. Thus, minimal to no effects are anticipated on EJ populations. However, safety-related effects on EJ populations associated with the transmission line would be further evaluated once the route and the particular activities are better known.	Safety-related effects would be temporary, minor and mitigated, and limited to the immediate project sites and transmission line corridors. While not anticipated, effects on EJ populations would be evaluated for individual solar and storage facilities.
Socioeconomics	Due to the loss of direct and indirect employment associated with CUF, competition for employment in other fields in the CUF labor market area, such as manufacturing, educational services, health care, and construction, may increase. Such trends could lead EJ populations and other populations to relocate for work or follow recent depopulation trends and permanently relocate to different locations in Tennessee or beyond. These changes may affect familial and community relations among EJ and other populations in the CUF labor market area. Given their particular vulnerabilities, the effects may be amplified for EJ populations. These effects would be offsite due to the benefit of temporary employment increases during D4 activities.	Construction of the CC plant and the pipeline associated with Alternative A would temporarily increase employment in the CUF labor market area and have a minor beneficial effect to area EJ populations. While not anticipated to have significant adverse impacts on minority communities or other EJ populations, there may be negative effects to current and prospective renters and guests of rental homes and establishments through reduced rental inventory and/or increased prices. This may result in amplified effects for EJ-qualifying low-income populations, especially in EJ-qualifying census block groups with higher percentages of renter-occupied housing units than the associated county, such as Dickson County CT 602 BG 1 and BG 3 and Houston County CT 1201 BG 2.	Construction and operation of the CT facilities associated with Alternative B would increase employment in the JCT and Gleason labor market areas, which could have minor beneficial effects on EJ populations. Minority EJ populations are present in the immediate vicinity of the JCT Reservation, and in total, six of the 19 census block groups within the JCT Reservation labor market area are minority EJ and/or low-income EJ populations (Figure 3.4-6 and Figure 3.4-7). While there are no EJ populations in the immediate vicinity of the Gleason Reservation, four of the 15 census block groups within the labor market area are low-income and/or minority EJ populations.	Construction of the solar facilities associated with Alternative C would temporarily increase employment in portions of Middle Tennessee. These socioeconomic effects could potentially have a minor beneficial effect to EJ populations in the areas selected for the solar facilities. Construction of projects in vicinity to the JCT and Gleason plants, such as JCT Aeroderivative project, could create short-term, beneficial cumulative effects to socioeconomics in their respective labor markets. These could combine with project effects and increase the beneficial effects to EJ and other populations.

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
Noise	Noise-related effects would be temporary and minor and generally limited to the TVA-owned CUF Reservation and immediate vicinity, where EJ populations are prominent. These effects would likely be experienced more readily by EJ populations given their proximity to the CUF Reservation; therefore, the EJ populations may experience amplified effects.	Alternative A-related activities would also increase the noise effects on local populations, both EJ and non-EJ. Given the prominence of EJ populations near the CC plant location and in the pipeline corridor, these effects would generally be experienced by EJ populations more than other populations. Further, some of the loudest activities and components are located in EJ areas. Pipeline-related noisy activities and components in EJ areas include the HDD locations and the Cumberland Meter Station, located at the western end of the pipeline corridor, at the CC plant location. While these effects would be mitigated as much as feasible, given their location in EJ areas, the noise effects associated with Alternative A may be amplified for EJ populations.	Noise-related effects from construction of the CT facility would be short-term, localized, and minor. While there are no EJ populations in the immediate vicinity of the Gleason Reservation, EJ populations are present near JCT. Therefore, these short-term negative conditions could have amplified effects on EJ populations, given their proximity to JCT. RFFAs in vicinity to the proposed CT plant, such as the JCT Aeroderivative plant, could create short-term, cumulative increases in construction and traffic noise in the area if this project occurs at the same time as implementation of Alternative B. This could increase the noise effects on EJ populations in the JCT vicinity. Overall, effects on EJ populations associated with the transmission line would be evaluated once the route and the particular activities are better known.	Noise effects would be anticipated to be the same for EJ and other populations in the vicinity of project sites and transmission line corridors. To determine amplified effects for a given solar facility, detailed EJ analyses would occur for each solar facility and transmission line activity under future NEPA reviews.
Visual	Visual effects would be temporary, minor, and limited to the TVA-owned CUF Reservation or immediate vicinity. The effects would generally be experienced more readily by EJ populations since they are more prominent in the immediate CUF vicinity; therefore, the effects could be amplified for EJ populations.	Alternative A-related activities would also increase the visual effects on local populations, both EJ and non-EJ. Given the prominence of EJ populations at the CC plant location and in the pipeline corridor, these effects would generally be experienced by EJ populations more than other populations. Further, some of the most visually intrusive activities and components, including the HDD locations and the Cumberland Meter Station, are located in EJ areas; therefore, these effects may be amplified for EJ populations.	Visual effects due to the CT facilities would be minor and generally limited to the immediate TVA-owned reservations or nearby vicinity. While there are no EJ populations in the immediate vicinity of the Gleason Reservation, EJ populations are present near JCT. Therefore, these short-term negative conditions could have amplified effects on EJ populations, given their proximity to JCT. Visual effects from transmission line construction and upgrade activities are expected to be short-term and	Visual effects would be localized and minor. While not anticipated to be significant, effects on EJ populations would be evaluated for individual solar and storage facilities.

Resource Area	CUF Coal Retirement - CUF coal facility retirement and D4 activities	Alternative A - proposed CC plant (CUF), offsite natural gas pipeline lateral, and CUF-sited transmission line activities	Alternative B - proposed CT facilities (JCT and Gleason) and offsite transmission line activities	Alternative C - proposed solar facilities with battery storage and offsite transmission line activities
			minimal and, thus, result in minimal effects. However, effects on EJ populations associated with the transmission line would be evaluated once the route and the particular activities are better known.	

3.5. Physical Characteristics

3.5.1. Geology, Soils, and Prime Farmland

3.5.1.1. Affected Environment

The alternative actions considered in this EIS would occur in one or more of the following major physiographic provinces and physiographic sections (Figure 3.5-1) (Fenneman 1938, Miller 1974):

- Interior Low Plateaus Province
  - Highland Rim
  - Nashville Basin
- Appalachian Plateaus Province
  - Cumberland Plateau
- Coastal Plain Province
  - East Gulf Coastal Plain

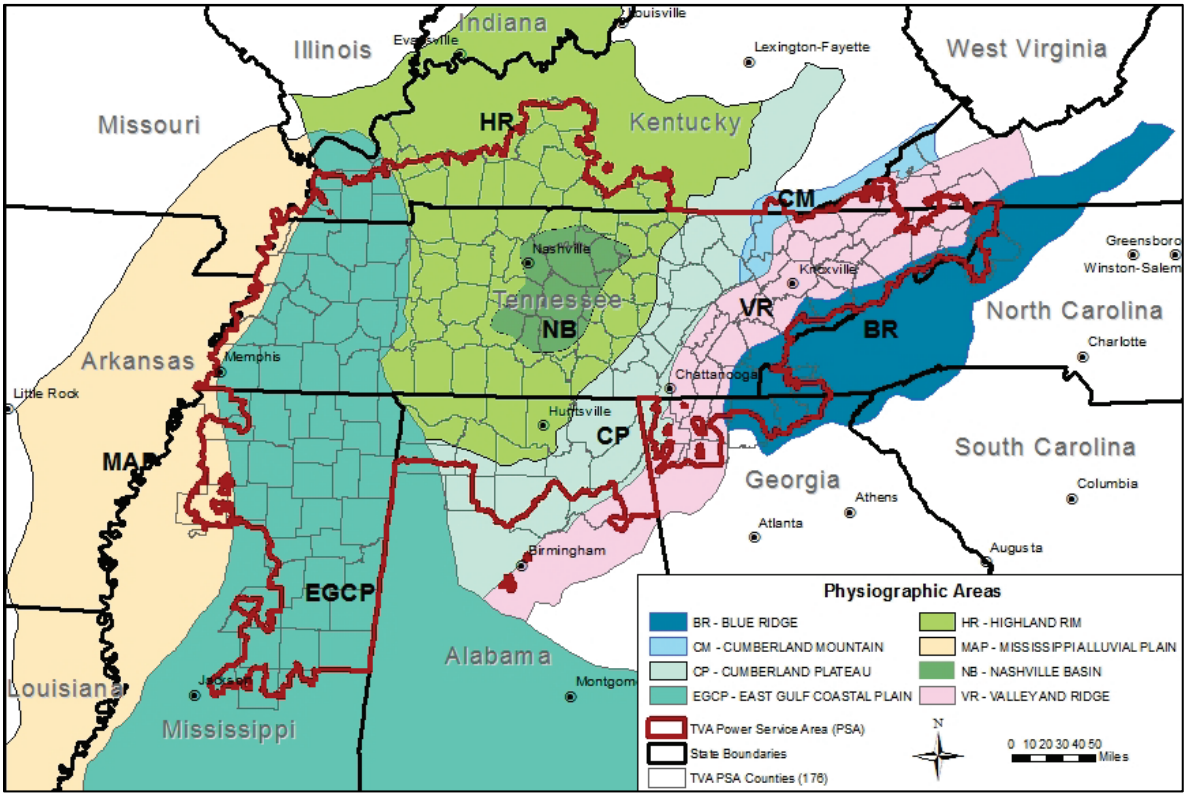

Figure 3.5-1. Physiographic areas of TVA region

3.5.1.1.1. CUF Reservation

Geology

The CUF Reservation lies in the Western Highland Rim Physiographic Province of Tennessee, which is characterized by rolling hills and incised valleys. Regionally, the underlying bedrock is chiefly Mississippian to Ordovician-age limestone, chert, shale, siltstone, and sandstone (Luther 2018; Griffith et al. 1997) of the Wells Creek Dolomite and Knox Group formations. According to Wilson and Sterns (1968), the Wells Creek Structure is the result of a meteor impact. The Wells

Creek Structure is approximately eight miles in diameter and consists of a series of roughly circular concentric faults (Figure 3.5-2) surrounding a topographically low area with a central hill. The low area has been named the Wells Creek Basin, within which the CUF Reservation is located. In addition to the circular faults, radial faults emanate from the center of the basin.

The geology of the Highland Rim section in which the Wells Creek Structure is located consists of relatively intact flat-lying geologic formations, but the bedrock formations within the basin are fractured and inclined at various angles and are in some cases oriented vertically. In addition, the bedrock formations within the basin are much older than those first encountered in the area surrounding the structure. The bedrock stratigraphy ranges from the Knox Dolomite in the central portion of the structure to the Paint Creek Limestone in the outer portion of the structure. According to Wilson and Sterns (1968), the preferred explanation for this difference is that the meteor impact brought older geologic formations that are found at a depth of approximately 2,500 feet in the surrounding Highland Rim section to the current ground surface in the center of the Wells Creek Basin. Material ejected by the impact settled back within the crater as rock fragments, which eventually resulted in a matrix of reconsolidated rock within the Wells Creek Basin that was more easily eroded. The Wells Creek Basin is approximately two miles in diameter and approximately 200 to 300 feet lower in elevation than the surrounding area.

The regional overburden geologic units consist of Quaternary-aged flood plain, deposits of the Cumberland River, and larger creeks, including Wells Creek. Alluvial deposits, consisting of mainly alluvial silts and clays, are located within the historic floodplain found below an elevation of 360 ft MSL. The alluvial deposits from Wells Creek overlaying bedrock are highly variable in thickness, ranging from 0 to 90 feet (Wilson and Sterns 1968). Where alluvium is absent, residuum derived from weathered rock overlies bedrock. Underlying the silt and clay, coarser grained alluvium consists of sand and gravel deposits that are discontinuous and pinch out with distance away from the former Wells Creek channel. The alluvium sand and gravels are underlain by varying bedrock units. Eight bedrock formations ranging from the Ordovician Hermitage Formation to the Mississippian Fort Payne Formation were mapped (Boggs 2011). Except for the Chattanooga Shale, bedrock primarily consists of various limestone formations. The Wells Creek Formation is up to 50 feet thick and characterized by gray limestone and dolomite with angular chert blocks and fragments and minor amounts of mottled red and green calcareous shale. The Knox Formation is up to 600 feet thick and is characterized by gray and cherty, fine- to medium-grained dolomite and limestone (Greene and Wolfe 2000; Hardeman et al. 1966).

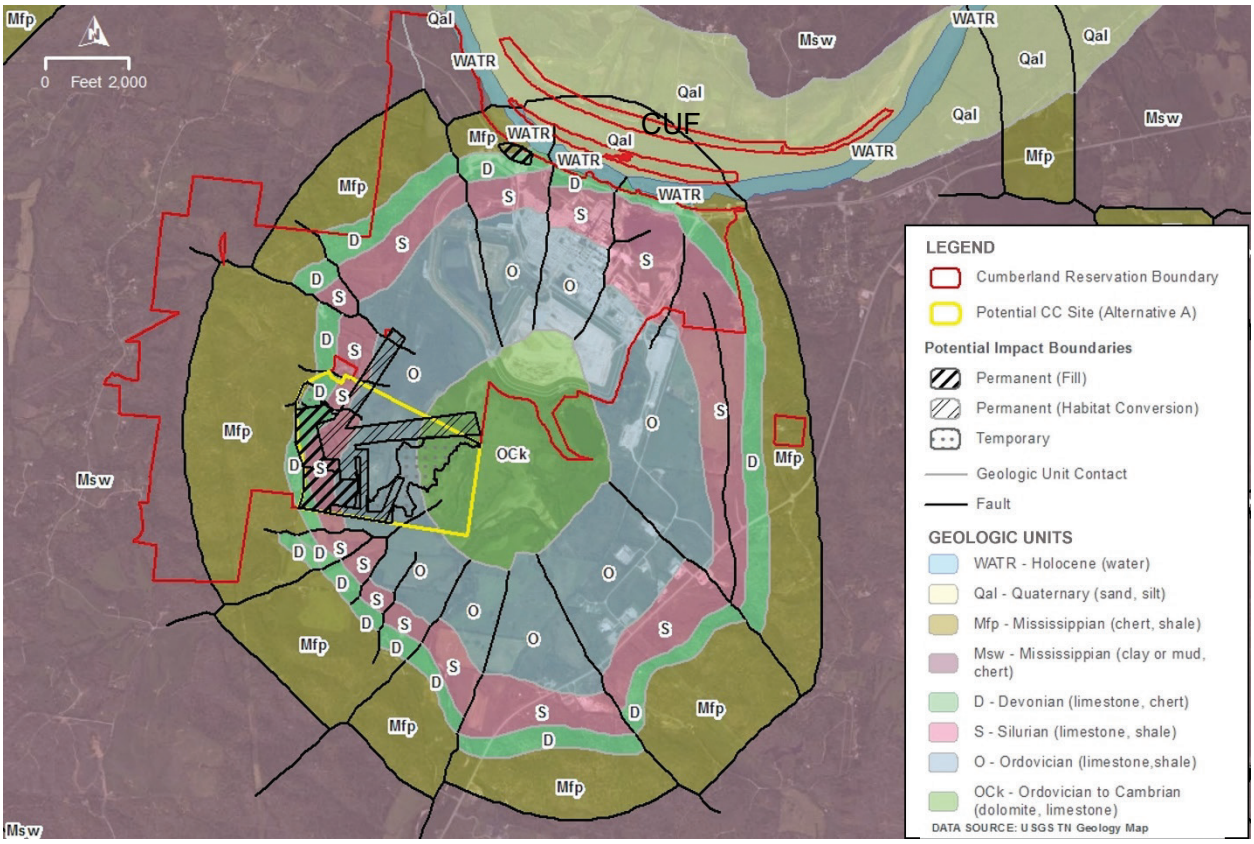

Figure 3.5-2. Regional geology, drainage, and mapped faults

Paleontology

During the Precambrian period, the area that is now Tennessee was located in the southern hemisphere and was covered by a shallow, tropical sea that was home to diverse species of sea life. By the Paleozoic period, Tennessee was located along the southern border of present-day North America and was still covered by sea water. During the Early Carboniferous (Mississippian) period, Tennessee was covered by a warm tropical sea that supported an abundance of marine life. The limestones produced from the sediments that accumulated on the seafloor during this period are rich in fossils of bryozoans, brachiopods, and crinoids. During the Late Carboniferous period, mountain building in the east caused soil erosion and deposition resulting in swampy deltas to form in central Tennessee. Western Tennessee continued to be underwater while the central and eastern portion of Tennessee was above sea level through the Mesozoic and Cenozoic periods (The Paleontology Portal 2021).

Fossil discovery is possible and likely throughout Tennessee. The geologic formations underlying the Project may contain fossiliferous remains of marine invertebrates. A review of existing paleontological information for Tennessee was conducted. While invertebrate fossils may be found in Tennessee, unique paleontological resources are not known to exist within the proposed location of the Project (Paleobiology Database 2022).

Geological Hazards

Geological hazards can include landslides, volcanoes, earthquakes/seismic activity, and subsidence/ sinkholes. The CUF Reservation is located on low undulating terrain. No significant slopes are present within several miles; therefore, landslides are not a potential risk. No volcanoes are present within several hundred miles of the CUF Reservation.

Sinkholes can occur where the rock below the land surface is a carbonate rock such as a limestone or dolomite, as well as in salt beds, and other rocks that can naturally be dissolved by groundwater circulating through them such as gypsum. The process typically can take many years to decades to form, and as the rock dissolves, spaces and caverns develop underground. Land over sinkholes may stay intact until there is not enough support for the land above the spaces. Then, a sudden collapse of the land surface can occur. These collapses can vary greatly in size and shape (Kaufmann 2007).

Because of the impact crater, referenced above, multiple faults are located in the vicinity of CUF Reservation. The presence of faults within the carbonate rocks can contribute to the formation of karst related features if groundwater is present and the fault planes are acting as a conduit for groundwater flow.

The Project site is located 85 miles from the New Madrid Seismic Zone, which is a 150-mile-long seismic zone extending from Illinois to Arkansas and into portions of five states (Figure 3.5-3). The largest seismic events in the area occurred in 1811 and 1812 (U.S. Geological Survey [USGS] 2021). Seismic instrumentation was installed in 1974 to monitor the area and since then, approximately 4,000 earthquakes have been recorded; however, they are typically too small to be felt. While the New Madrid Fault Line is considered a potential source of intraplate earthquakes in the region, the faults responsible for associated seismic activity are ancient (i.e., no recent faulting) and deep seated. Land movement along the fault system is minimal to none, and GPS measurements from a recent study indicated that faults are moving less than 0.2 millimeters per year, which could indicate that the potential for larger earthquakes in the area has diminished (Gardner 2009).

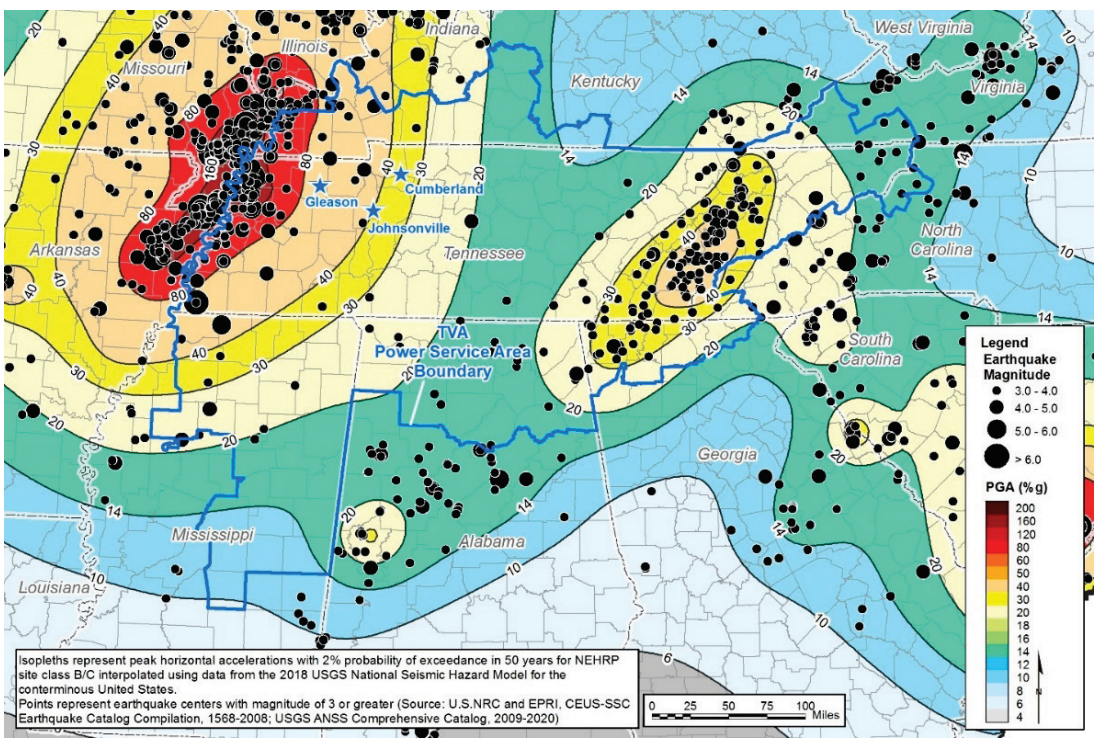

Figure 3.5-3. Seismic hazards from the New Madrid Fault Line.
(Source: Modified after USGS 2018)

Soils

Thirty-nine soil types have been mapped on the CUF Reservation and the majority are composed of Bodine gravelly silt loam, 20 to 40 percent slopes (14.3 percent); Lindell silt loam, zero to two percent slopes, occasionally flooded (10.8 percent); Maury silty clay loam, five to 12 percent slopes, eroded (8.6 percent); Melvin silt loam, frequently flooded (7.8 percent); and Bodine gravelly silt loam, 12 to 20 percent slopes (6.9 percent); with other types of soil consisting of less than five percent each (USDA 2019a; Figure 3.5-4, Table 3.5-1). The Melvin silt loam, frequently flooded soil has a hydric rating of 100 percent and the Lindell silt loam, zero to two percent slopes, occasionally flooded and Taft silt loam, zero to two percent slopes soils have hydric ratings of one to 33 percent. Hydric soils are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Hydric rating is an indicator of the percentage of a map unit that meets the criteria for hydric soils (USDA 2019a).

The Bodine series soils consist of very deep, somewhat excessively drained, gravelly soils that formed in residuum weathered from cherty limestone. These soils are on sharply dissected uplands with slopes ranging from five to 70 percent. These soils are primarily in forested areas, but small, cleared areas are used mostly for pasture. The Lindell series soils consist of very deep, moderately well drained soils that formed in loamy alluvium. These soils are on the floodplains of rivers, creeks, and smaller streams with slopes ranging from zero to three percent. These soils are used for growing corn, soybeans, hay, and pasture. The Maury series soils consist of very deep, well drained, moderately permeable soils that formed in silty material over residuum weathered from phosphatic limestone. These soils are on uplands with slopes commonly from zero to 12 percent but ranging to 20 percent. These soils are used for pasture and for crops such as burley tobacco, corn, small grains, and alfalfa. The Melvin series soils consist of very deep, poorly drained soils formed in silty alluvium. These soils are on floodplains and in upland depressions with slopes ranging from zero to two percent. These soils, where previously drained, are used for corn, sorghum, soybeans, and hay. Many areas are used for wetland wildlife habitat (USDA 2021).

Prime Farmland

The term “prime farmland” is assigned by the USDA to land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for such uses. The Farmland Protection Policy Act (FPPA; 7 U.S.C. § 4201 et seq.) requires federal agencies to consider the adverse effects of their actions on prime or unique farmland. Farmland subject to FPPA requirements does not have to be currently used for cropland. The land can be forested land, pastureland, cropland, or other land, but it cannot be water or urban built-up land. The purpose of the FPPA is “to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses.” FPPA does not authorize federal agencies to regulate the use of private or non-federal land, or in any way affect the property rights of owners.

Based on soils data obtained from the USDA Web Soil Survey, approximately 587 acres (24.6 percent) of the CUF Reservation are designated as prime farmland, as illustrated in Figure 3.5-5. Table 3.5-2 describes the soil types, including those classified as prime farmland, located on the CUF Reservation.

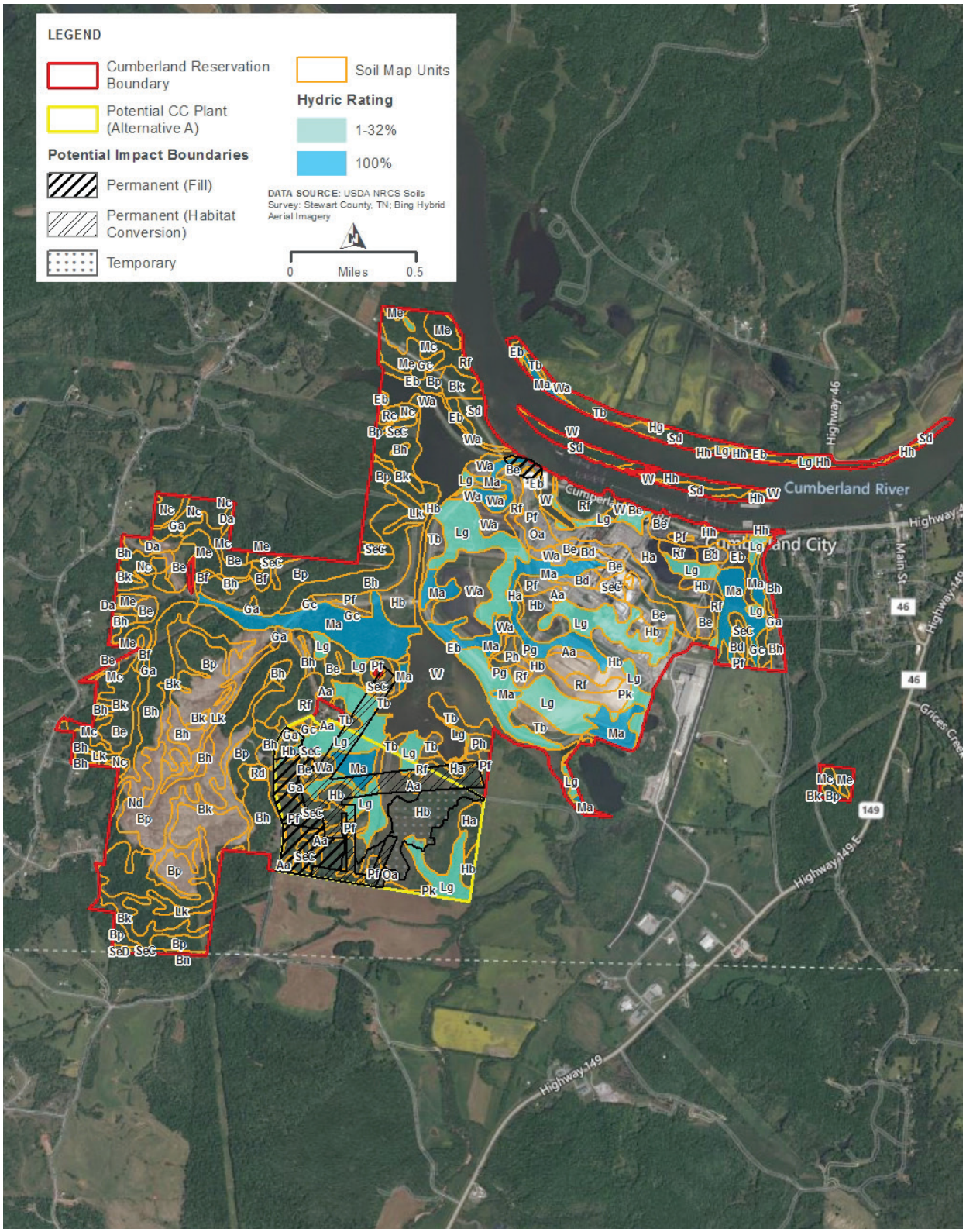

Figure 3.5-4. Soils on the CUF Reservation

Table 3.5-1. Soils on the CUF Reservation

Soil Map Unit Symbol	Soil type	Farmland classification	Hydric Rating	Area (acres)	Percentage of area
Aa	Nolin silt loam, occasionally ponded	All areas are prime farmland	0	34.0	1.4%
Bd	Sengtown gravelly silt loam, 12 to 20 percent slopes, severely eroded	Not prime farmland	0	16.7	0.7%
Be	Sengtown gravelly silt loam, 12 to 20 percent slopes	Not prime farmland	0	100.2	4.2%
Bf	Sengtown gravelly silt loam, 30 to 60 percent slopes	Not prime farmland	0	7.0	0.3%
Bh	Bodine gravelly silt loam, 12 to 20 percent slopes	Not prime farmland	0	164.0	6.9%
Bk	Bodine gravelly silt loam, 5 to 12 percent slopes	Not prime farmland	0	96.8	4.1%
Bn	Bodine gravelly silt loam, 20 to 40 percent slopes	Not prime farmland	0	1.5	0.1%
Bp	Bodine gravelly silt loam, 20 to 40 percent slopes	Not prime farmland	0	342.4	14.3%
Da	Dickson silt loam, 5 to 12 percent slopes	Not prime farmland	0	13.3	0.6%
Eb	Egam silty clay loam, occasionally flooded	All areas are prime farmland	0	27.9	1.2%
Ga	Greendale cherty silt loam, undulating phase	All areas are prime farmland	0	0.3	<0.1%
Ga	Humphreys gravelly silt loam, 2 to 5 percent slopes	All areas are prime farmland	0	43.3	1.8%
Gc	Trace silt loam, 2 to 5 percent slopes	All areas are prime farmland	0	12.0	0.5%
Ha	Maury silty clay loam, 12 to 20 percent slopes, eroded	Not prime farmland	0	53.0	2.2%
Hb	Maury silty clay loam, 5 to 12 percent slopes, eroded	Not prime farmland	0	205.4	8.6%
Hg	Sequatchie fine sandy loam, 2 to 5 percent slopes	All areas are prime farmland	0	0.9	<0.1%
Hh	Nolin silt loam, occasionally flooded	All areas are prime farmland	0	29.0	1.2%
Lg	Lindell silt loam, 0 to 2 percent slopes, occasionally flooded	All areas are prime farmland	4	258.4	10.8%
Lk	Lobelville silt loam, occasionally flooded	All areas are prime farmland	0	33.8	1.4%
Ma	Melvin silt loam, frequently flooded	Not prime farmland	100	186.1	7.8%
Mc	Mountview silt loam, 5 to 12 percent slopes, eroded	Not prime farmland	0	47.5	2.0%
Me	Sengtown silt loam, 12 to 20 percent slopes	Not prime farmland	0	50.2	2.1%
Mf	Mountview silt loam, 5 to 12 percent slopes	Not prime farmland	0	0.6	<0.1%

Soil Map Unit Symbol	Soil type	Farmland classification	Hydric Rating	Area (acres)	Percentage of area
Nc	Hawthorne gravelly silt loam, 12 to 20 percent slopes	Not prime farmland	0	43.5	1.8%
Nd	Sugargrove gravelly silt loam, 5 to 12 percent slopes	Not prime farmland	0	19.7	0.8%
Oa	Newark silt loam, occasionally ponded	Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season	0	3.8	0.2%
Pf	Byler silt loam, 5 to 12 percent slopes, eroded	Not prime farmland	0	84.6	3.5%
Pg	Armour silt loam, 12 to 20 percent slopes	Not prime farmland	0	4.4	0.2%
Ph	Armour silt loam, 5 to 12 percent slopes	Not prime farmland	0	8.6	0.4%
Pk	Armour silt loam, 2 to 5 percent slopes, eroded	All areas are prime farmland	0	18.6	0.8%
Rc	Sengtown-Gullied land complex, 12 to 20 percent slopes	Not prime farmland	0	3.1	0.1%
Rd	Dickson-Gullied land complex, 2 to 12 percent slopes	Not prime farmland	0	2.8	0.1%
Sd	Staser fine sandy loam, occasionally flooded	All areas are prime farmland	0	47.9	2.0%
SeC	Sengtown gravelly silt loam, 5 to 12 percent slopes	Not prime farmland	0	60.4	2.5%
SeD	Sengtown gravelly silt loam, 12 to 20 percent slopes	Not prime farmland	0	1.0	<0.1%
SeF	Sengtown gravelly silt loam, 30 to 60 percent slopes	Not prime farmland	0	0.1	<0.1%
Ta	Taft silt loam, 0 to 2 percent slopes	Not prime farmland	4	0.8	<0.1%
Tb	Gumdale silt loam, rarely flooded	Not prime farmland	0	62.0	2.6%
W	Water	Not prime farmland	0	162.7	6.8%
Wa	Wolftever silt loam, 1 to 5 percent slopes, occasionally flooded	All areas are prime farmland	0	77.1	3.2%
	Total Prime Farmland			587	24.6%

Source: USDA 2019b

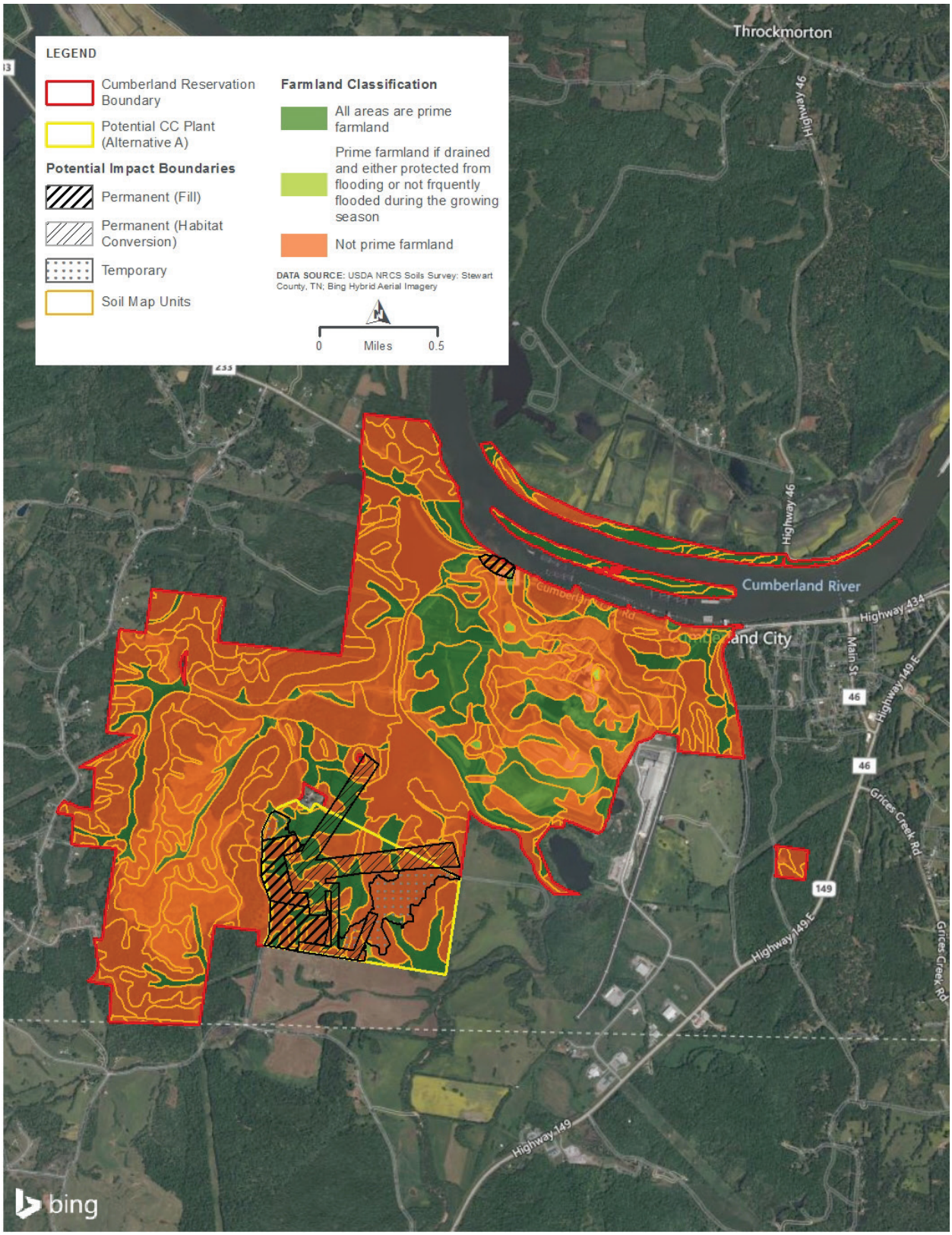

Figure 3.5-5. Soils classified as prime farmland on the CUF Reservation

3.5.1.1.2. Alternative A

3.5.1.1.2.1. Proposed CC Plant

Geology

The proposed CC Plant lies in the Western Highland Rim Physiographic Province of Tennessee as described in Section 3.5.1.1.1.

Paleontology

The paleontology associated with the proposed CC Plant is generally the same as described in Section 3.5.1.1.1.

Geological Hazards

The geological hazards associated with the proposed CC Plant are generally the same as described in Section 3.5.1.1.1., and the plant site is on low undulating terrain. No significant slopes are present near the site; therefore, landslides are not a potential risk. The plant site is not an area recognized for carbonate-based karst geological conditions (TGP Resource Report 6, Figure 6.A.8) due to the carbonate bedrock being soluble in slightly acidic water.

TVA retained S&ME, Inc. (S&ME) to complete a Report of Geotechnical Exploration of the plant site (S&ME 2022). The study investigated general subsurface conditions of the area to evaluate the engineering characteristics of the on-site soils and bedrock and provided geotechnical recommendations for foundation support. The investigation included standard penetration testing, multi-channel analysis of surface wave, and micro-tremor array measurement geophysical surveys.

Neither surface signs of sinkhole activity at the site nor patterns of closed depressions on the USGS Topographic Quadrangle Maps for the area that would indicate sinkhole activity were observed in near proximity to the site. However, several of the test borings drilled at the site during this investigation encountered evidence of solution weathering of the bedrock, such as deep clay soils slots between shallow refusal areas, highly weathered / low quality rock core, and clay filled or open voids in the rock core. S&ME found that the risk of sinkhole development at the proposed CC Plant site is no greater than at other sites located within similar geologic settings in the surrounding area that have been developed successfully.

S&ME drilled 54 soil test borings at the site to planned depths, or the point at which drilling could not advance any farther due to limitations of the drilling equipment or obstruction. Rock coring was performed in 29 of the test borings. The bedrock generally consisted of highly weathered to fresh gray limestone with interbedded shale. Approximately 30 to 100 percent of the rock core was recovered. The Rock Quality Designation, a measure used to describe quality of rock and is used for determining usability (i.e., depth, stability, bearing capacity, etc.) for specific uses (i.e., construction, foundations, tunneling, etc.), was 0 percent, indicating very poor rock quality.

Liquefaction, the loss of a soil's shear strength due to an increase in porewater pressure resulting from seismic vibrations, is a design concern for strong shaking of loose, saturated, granular soils. While there is a possibility of strong shaking at the site, loose, saturated, granular soils are generally not present. The subsurface conditions at the proposed CC plant site consist of fat clays, lean clays, and elastic silt, with Plasticity Indices (PI) typically from 16 to 33. With respect to dynamic performance and based on published information, soils having a PI greater than 7 will exhibit clay-like behavior and are generally not susceptible to liquefaction. Additionally, the shear wave velocity of these soils is typically greater than 750 feet per second,

which is another indicator that they are not liquefiable. Therefore, liquefaction is not a design concern for structures supported on these soils.

Soils

Sixteen soil types have been mapped in the area of the proposed CC plant and associated TL upgrades. The majority are composed of Maury silty clay loam, 5 to 12 percent slopes, eroded (39.5 percent); Byler silt loam, 5 to 12 percent slopes, eroded (16 percent); Lindell silt loam, zero to two percent slopes, occasionally flooded (12.6 percent); Nolin silt loam, occasionally ponded (8.7 percent); and Sengtown gravelly silt loam, 5 to 12 percent slopes (7.6 percent) (USDA 2019a; Figure 3.5-4; Table 3.5-2). Other soil types comprise less than five percent each. All of the soil types that make up a majority of the site are considered to be not hydric, except for Lindell silt loam, which has a hydric rating of four percent.

The Maury series soils consist of very deep, well drained, moderately permeable soils that formed in silty material over residuum weathered from phosphatic limestone. These soils are on uplands with slopes commonly from zero to 12 percent but ranging to 20 percent. These soils are used for pasture and for crops such as burley tobacco, corn, small grains, and alfalfa. The Byler series soils consist of very deep, moderately well drained soils with a fragipan. It is on nearly level to undulating stream terraces. The soil formed in silty alluvium and the underlying clayey residuum of limestone. The Byler soils are nearly level to undulating stream terraces of the Nashville Basin and adjacent drainage systems. Most of the soil has been cleared and is used for growing pasture, hay, soybeans, small grain, grain sorghum, and silage crops. A small acreage is in forest dominantly hickory, oak, hackberry, red cedar, and elm. The Lindell series soils consist of very deep, moderately well drained soils on floodplains formed in loamy alluvium. Lindell soils are on the floodplains of rivers, creeks, and smaller streams. Slopes are mainly less than one percent but range up to about three percent along narrow drainageways. These soils are used for growing corn, soybeans, hay, and pasture. The native vegetation was mixed hardwoods. The Nolin series consists of very deep, well drained soils formed in alluvium derived from limestones, sandstones, siltstones, shales, and loess. These nearly level to moderately steep soils are on floodplains, in depressions which receive runoff from surrounding slopes, or on natural levees of major streams and rivers. The Nolin soils are on nearly level floodplains, in concave depressions, or on natural levees of major rivers and streams. The soils formed in alluvium derived from limestone, sandstone, siltstone, shale, and loess. The surface runoff is negligible to low on nearly level slopes and ranges to rapid on steeper banks of streams and rivers. Permeability is moderate. Most areas are used for growing corn, tobacco, soybeans, and hay. Forested areas are bottomland hardwoods, such as river birch, yellow-poplar, sycamore, elm, willow, boxelder, oak, hickory, and red maple. Many stream banks and narrow floodplains consist of native canebrakes. The Sengtown series consists of very deep, well drained, moderately permeable soils on uplands. They formed in residuum weathered from cherty limestone. These soils are on uplands with slopes ranging from two to 60 percent. They are well drained with medium to very high runoff and moderately slow to slow permeability. Cleared areas are used for pasture, hay, small grain, tobacco, and corn. The remaining areas are in oak-hickory forest (USDA 2021).

Prime Farmland

Based on soils data obtained from the USDA Web Soil Survey, approximately 53 acres (27 percent) of the site are designated as prime farmland, as illustrated in Figure 3.5-5 and further described in Table 3.5-2.

Table 3.5-2. Soils on the revised potential impact boundaries

Soil Map Unit Symbol	Soil type	Farmland classification	Hydric Rating	Area (acres)	Percentage of area
Aa	Nolin silt loam, occasionally ponded	All areas are prime farmland	0	17.0	8.7%
Be	Sengtown gravelly silt loam, 12 to 20 percent slopes	Not prime farmland	0	5.5	2.8%
Bh	Bodine gravelly silt loam, 12 to 20 percent slopes	Not prime farmland	0	1.7	0.9%
Eb	Egam silty clay loam, occasionally flooded	All areas are prime farmland	0	0.4	0.2%
Ga	Greendale cherty silt loam, undulating phase	All areas are prime farmland	0	6.3	3.2%
Ha	Maury silty clay loam, 12 to 20 percent slopes, eroded	Not prime farmland	0	2.9	1.5%
Hb	Maury silty clay loam, 5 to 12 percent slopes, eroded	Not prime farmland	0	77.3	39.5%
Lg	Lindell silt loam, 0 to 2 percent slopes, occasionally flooded	All areas are prime farmland	4	24.6	12.6%
Ma	Melvin silt loam, frequently flooded	Not prime farmland	100	5.6	2.9%
Oa	Newark silt loam, occasionally ponded	Prime farmland if drained	0	0.3	0.1%
Pf	Byler silt loam, 5 to 12 percent slopes, eroded	Not prime farmland	0	31.3	16.0%
Pk	Armour silt loam, 2 to 5 percent slopes, eroded	All areas are prime farmland	0	0.0	0.0%
Rf	Ridgebury extremely stony fine sandy loams	Not prime farmland	0	0.6	0.3%
SeC	Sengtown gravelly silt loam, 5 to 12 percent slopes	Not prime farmland	0	14.8	7.6%
Tb	Gumdale silt loam, rarely flooded	Not prime farmland	0	3.0	1.5%
W	Water	Not prime farmland	0	0.1	0.0%
Wa	Wolftever silt loam, 1 to 5 percent slopes, occasionally flooded	All areas are prime farmland	0	4.3	2.2%
	Total Prime Farmland			52.9	27.0%

Source: USDA 2019b

3.5.1.1.2.2. Natural Gas Pipeline Corridor

While typical pipeline corridors are 100-feet and 50-feet wide for construction and operation, respectively, TVA's analysis uses a more conservative, 200-foot-wide corridor in this EIS to allow for adjustments that may be required by TGP resulting from consultations with agencies and pending permitting decisions. As such, the following descriptions of resources within the 32-mile pipeline corridor are based on the assumption that the corridor is 200 feet wide.

Geology

The proposed natural gas pipeline corridor lies in the Western Highland Rim Physiographic Province of Tennessee as described in Section 3.5.1.1.1. TGP identified fuel and non-fuel mineral resources in the vicinity of the pipeline corridor (TPG 2022f). As stated in TGP's Resource Report 6 (TGP 2022f):

> […] Eight oil and gas wells [are] located within 0.25 mile of the [pipeline corridor]. Two of these wells are located in the Project area, one in the permanent ROW at milepost ("MP") 16.1, and one adjacent to an access road at approximate MP 5.3. Neither of these wells is visible on aerial imagery nor were they documented as having been observed during field survey activities. No impacts on these wells are anticipated during construction or operation of the [pipeline].
>
> According to the USGS Mineral Resources Data System (MRDS), there are two identified, non-fuel mineral resources located within 0.25 mile of the Project area within Dickson County. The first resource encountered is listed as an iron prospect identified as the Gilliam Prospect. This resource is located approximately 500 feet southwest of milepost MP 5. This prospect appears to be located within an area that is forested and undeveloped based on aerial imagery. The location of this mineral resource is also southwest of the existing TVA electrical transmission corridor that further separates the [pipeline] area from the potential prospect source.
>
> The second mapped mineral resource within Dickson County is identified as a past producer, iron surface mine (Stokes Ore Bank). The USGS identifies this surface mine approximately 500 feet northwest of MP 13.2; however, the location provided by USGS places this resource within an undeveloped/forested area and does not seem to represent the location of an abandoned surface mine. This resource is also located north of the existing TVA electrical transmission corridor, further separating the [pipeline] area from denoted location of the surface mine (USGS 2022).
>
> […] According to the USGS MRDS, there is a single identified non-fuel mineral resource located within 0.25 mile of the Project area in Stewart County near MP 30. The mineral resource identified within the MRDS is listed as a portion of the Cumberland City Quarry, a crushed stone surface mine that is listed as no longer active (USGS 2022). The topographic quadrangle map provided in [Appendix 1.A.2, map page 11, of TGP Resource Report 1, General Project Description], identifies a quarry approximately 750 feet north of MP 30. Due to the distance of this mine from the [pipeline] and the determination in Section 8.5 of TGP Resource Report 8, Land Use, Recreation and Aesthetics, that contaminated sediments are not anticipated, no impacts on the [pipeline] from past operation of this mine are expected. In addition, since the mine is no longer in operation, no impacts on the mine from the construction and operation of the pipeline are anticipated.

Paleontology

The paleontology associated with the 32-mile pipeline corridor is generally the same as described in Section 3.5.1.1.1.

TGP Resource Report 6 (2022f) states:

The geologic formations underlying the [pipeline] are Paleozoic in age and may contain fossiliferous remains of marine invertebrates. A review of existing paleontological information for Tennessee was conducted. While invertebrate fossils may be found in Tennessee, unique paleontological resources are not known to exist within the proposed location of the [pipeline] (Paleobiology Database 2022).

Geological Hazards

The geological hazards associated with the 32-mile pipeline corridor are generally the same as described in Section 3.5.1.1.1. The corridor is generally located on low undulating terrain; therefore, landslides are not a potential risk.

TGP retained Geosyntec Consultants ("Geosyntec") to complete a Phase I Geological and Hydrotechnical Hazard Assessment for the [pipeline] area, which included a detailed desktop evaluation on landslides, ground subsidence, seismic hazards, and flood and scour potential.

As stated in TGP's Resource Report 6 (2022f):

> […] Considering the lack of reported seismic events near the [pipeline] area and the absence of injection wells in the area, the likelihood for induced seismicity in the [pipeline] appears to be low. […] No quaternary fault crossings were identified within 500 feet of the [pipeline] corridor.
>
> Geologic resources that were identified within 0.25 mile of the pipeline workspaces are past producers or prospects where expansion of the identified resource is precluded by roads, waterbodies, property boundaries, and/or existing utilities and pipelines. Eight oil and gas wells were located within 0.25 mile of the corridor. Two of these wells are located in the pipeline area – one in the permanent ROW at MP 16.1, and one adjacent to an access road at approximate MP 5.3. Neither of these wells is visible on aerial imagery, nor were they documented as having been observed during field survey activities.

Based on the results of the Phase I Assessment, TGP retained Geosyntec to develop site-specific steep slope mitigation plans for the pipeline area. During Geosyntec's Phase II Assessment field reconnaissance, it was determined that steep slope areas generally are characterized as shallow or exposed bedrock and do not show signs of ground instability. Based on the results of the Phase II Assessment, no site-specific recommendations were prepared to address slope stability or landslides; however, TGP provides general mitigation guidance for construction on and around steep and/or unstable slopes, to prevent currently stable slopes from becoming unstable during or following pipeline construction (TGP 2022f). The results of Geosyntec's Phase II Assessment will be incorporated in FERC's review of the pipeline.

TGP also retained Geosyntec to evaluate the 32 potential karst features in the corridor. Of the 32 identified karst features, "12 were field confirmed as karst hazards, two could not be evaluated due to lack of landowner access permission, and the remaining 18 were determined not to be karst hazards. Four of the 12 confirmed hazards were considered to be far enough from the pipeline that they are not anticipated to directly pose construction threats and can thus be addressed through the Karst Hazards Mitigation Guidance Plan" (Appendix 6.D of TGP Resource Report 6). At seven of the eight remaining sites, additional subsurface characterization was conducted to determine if site-specific construction guidelines were necessary. Due to lack of landowner access permission, the eighth site could not be accessed for additional characterization. At each of the 7 remaining sites, geophysical investigations were completed along the proposed pipeline alignment through the mapped karst feature(s). […]

Ultimately, based on the results of the geophysical surveys and information collected during the prior assessments, significant subsurface karst features (e.g., voids) are not anticipated to be encountered during construction at the reviewed locations and site-specific mitigation plans through these areas are not considered necessary. The Karst Hazards Mitigation Guidance Plan will be followed for construction through all karst areas identified along the route to address unexpected conditions that may be encountered in these or other areas and to avoid causing construction-related adverse impacts associated with constructing in karst prone areas.

As stated in TGP's Resource Report 6 (TGP 2022f),

> Ground subsidence could occur in areas where the potential for karst development has been identified. The structural integrity of a pipeline greatly reduces the probability that a sinkhole would impact the integrity of the pipeline. […] TGP will routinely monitor the geotechnical integrity of the [pipeline] sites as part of its current operations and maintenance activities for its pipeline system. Potential impacts to the geotechnical integrity of the [pipeline] from karst would be identified, and corrective actions immediately implemented, to ensure the safe operations of TGP's system. Localized settling or possible "cracking" of the soil in or near potential karst features would be observed and noted during inspections. These areas would be noted and inspected by TGP personnel. If required, maintenance work would be performed to correct the situation by re-grading, installing additional soil, or mitigating the sinkhole.
>
> As part of the Phase II Assessment, Geosyntec characterized potentially liquefiable soils at three assessment locations, and confirmed that the alluvial soils along the pipeline generally consist of weathered conglomerate with a low potential to liquefy. As described in Geosyntec's Geohazard Mitigation Guidance Plans, liquefaction was concluded to pose a low threat to the [pipeline], and as such, mitigation guidance plans to address seismic hazards were not considered necessary. Hazards resulting from geological conditions may be encountered in the case of sinkholes.

Central Tennessee is predominantly located over limestone bedrock that is susceptible to erosion and the creation of sinkholes. Based on the finalized location of the natural gas pipeline corridor and the results of the survey efforts described above, sinkholes could be a minimal risk.

Soils

According to TGP's Resource Report 7 (TGP 2022g),

> This section identifies and describes the soils within the corridor for the proposed pipeline based on USDA NRCS Soil Survey Information for Dickson, Houston, and Stewart counties, Tennessee (USDA 2022a). The pipeline crosses 63 different soil map units. Generally, these soils range from somewhat excessively drained to poorly drained and are dominated by silty loam textures. These soils generally have a deep depth to the root restrictive layer, [at which soil conditions become unfavorable to root penetration]. They typically do not flood or pond and rarely meet hydric criteria.
>
> The majority are composed of Sengtown gravelly silt loam, 30 to 60 percent slopes (18.9 percent); Sengtown gravelly silt loam, five to 12 percent slopes (18.1 percent); Sengtown gravelly silt loam, 12 to 20 percent slopes (15.8 percent); and Hawthorne-Sulphura association, 20 to 60 percent slopes (7.8 percent); with other

types of soil consisting of less than three percent each (USDA 2019a; Appendix C). The Melvin silt loam frequently flooded and Robertsville silt loam soils have a hydric rating of 100 percent and the Lindell silt loam, zero to two percent slopes, occasionally flooded and Taft silt loam, zero to two percent slopes soils have hydric ratings of one to 33 percent. The soil types most prone to flooding (Melvin, Robertsville, and Lindell) make up approximately 2.5% of the Study Area.

The Sengtown series soils consist of very deep, well drained, moderately permeable soils that formed in residuum weathered from cherty limestone. These soils are on uplands with slopes ranging from two to 60 percent. These soils are used for pasture, hay, small grain, tobacco, and corn. The Hawthorne series soils consist of moderately deep, somewhat excessively drained soils that formed in residuum of interbedded siltstone and cherty limestone. These soils are on uplands with slopes ranging from five to 70 percent. These soils are used for pasture or hay. The Sulphura series soils consist of moderately deep, somewhat excessively drained soils that formed in residuum of interbedded siltstone, limestone, and shale. These soils are on highly dissected uplands with slopes ranging from five to 75 percent. These soils are used for pasture (USDA 2021).

The construction workspace associated with Contractor Yard 1 would cross four different soil map units (TGP 2022a). These soil types are Ennis silt loam; Greendale cherty silt loam, undulating phase; Humphreys silt loam; and Sengtown gravelly silt loam (12 to 20 percent slopes). The construction workspace associated with Contractor Yard 2 would cross three different soil map units. These are Armour silt loam, 2 to 5 percent slopes, gravelly substratum; Armour silt loam, 5 to 12 percent slopes; and Sullivan silt loam, occasionally flooded. The construction workspace associated with the pressure regulation station would impact three different soil map units. These soil types are Hawthorne-Sulphura association, 20 to 60 percent slopes; Mountview silt loam, 5 to 12 percent slopes, eroded; and Sengtown gravelly silt loam, 5 to 12 percent slopes. The construction workspace associated with the Cumberland meter station would cross three different soil map units: Nolin silt loam, occasionally ponded; Maury silty clay loam, 12 to 20 percent slopes, eroded; and Byler silt loam, 5 to 12 percent slopes, eroded. Of the 38.90 acres affected by pipeline access roads, 38.78 acres are associated with temporary access roads and would be temporary impacted, and 0.12 acre is associated with permanent access roads at the pressure regulation station, the main line valve, and the Cumberland meter station, and would be permanently impacted.

Special construction techniques may be employed where slope gradient exceeds 30 percent, where construction activity must be conducted on side slopes, or where ground conditions warrant the use of such techniques to ensure the safety of workers, the public, or the environment. Construction activities across steep slopes would be similar to standard upland construction methods. Spoil piles would be stabilized with temporary sediment controls as needed to keep excavated soils within the construction work area. All sediment and erosion controls would be installed in accordance with FERC's Upland Erosion Control, Revegetation, and Maintenance Plan and FERC Procedures (with requested deviations).

Prime Farmland

Based on USDA Web Soil Survey data, a total of 195 acres (17.4 percent) of the area affected by construction and operation of the pipeline is prime farmland and 231 acres (20.5%) is farmland of local importance. This makes agricultural surface and sub-surface drainage systems and irrigation systems within the pipeline area possible. Table 3.5-3 describes the soil types,

including those classified as prime farmland, located within the pipeline corridor. Appendix D provides additional details on these soils.

Table 3.5-3. Soils on the Natural Gas Pipeline Corridor

Soil Map Unit Symbol	Soil type	Farmland classification	Hydric Rating	Area (acres)	Percentage of area
Aa	Nolin silt loam, occasionally ponded	All areas are prime farmland	0	2.4	0.2%
ArA	Armour silt loam, 0 to 2 percent slopes, gravelly substratum, occasionally flooded	All areas are prime farmland	0	10.6	0.9%
ArB	Armour silt loam, 2 to 5 percent slopes, gravelly substratum	All areas are prime farmland	0	24.9	2.2%
ArC	Armour silt loam, 5 to 12 percent slopes	Not prime farmland	0	16.5	1.5%
Bh	Bodine gravelly silt loam, 5 to 12 percent slopes	Not prime farmland	0	3.3	0.3%
Bl	Bodine gravelly silt loam, 12 to 20 percent slopes	Not prime farmland	0	7.6	0.7%
Bn	Bodine gravelly silt loam, 20 to 40 percent slopes	Not prime farmland	0	12.5	1.1%
ByB2	Byler silt loam, 2 to 5 percent slopes, eroded	All areas are prime farmland	0	10.3	0.9%
Eb	Egam silty clay loam, occasionally flooded	All areas are prime farmland	0	1.9	0.2%
Eb	Ennis cherty silt loam	All areas are prime farmland	0	8.8	0.8%
Ec	Ennis silt loam	All areas are prime farmland	0	10.0	0.9%
Ga	Greendale cherty silt loam, undulating phase	All areas are prime farmland	0	30.5	2.7%
Ha	Humphreys gravelly silt loam, 2 to 5 percent slopes	All areas are prime farmland	0	2.3	0.2%
Ha	Maury silty clay loam, 12 to 20 percent slopes, eroded	Not prime farmland	0	0.2	<0.1%
HaD	Hawthorne gravelly silt loam, 12 to 20 percent slopes	Not prime farmland	0	6.4	0.6%
Hb	Humphreys silt loam	All areas are prime farmland	0	24.6	2.2%
Hb	Maury silty clay loam, 5 to 12 percent slopes, eroded	Not prime farmland	0	7.2	0.6%
HgC	Hawthorne-Sugargrove complex, 5 to 12 percent slopes	Not prime farmland	0	8.2	0.7%
HsF	Hawthorne-Sulphura association, 20 to 60 percent slopes	Not prime farmland	0	87.4	7.8%

Soil Map Unit Symbol	Soil type	Farmland classification	Hydric Rating	Area (acres)	Percentage of area
HuB	Humphreys gravelly silt loam, 2 to 5 percent slopes	All areas are prime farmland	0	4.1	0.4%
HuC	Humphreys gravelly silt loam, 5 to 12 percent slopes	Not prime farmland	0	3.3	0.3%
Lc	Lobelville silt loam	All areas are prime farmland	0	0.2	<0.1%
Ld	Lindell silt loam, 0 to 2 percent slopes, occasionally flooded	All areas are prime farmland	4	21.1	1.8%
Ma	Maury silt loam, eroded rolling shallow phase	Not prime farmland	0	5.7	0.5%
Ma	Melvin silt loam, frequently flooded	Not prime farmland	100	6.5	0.6%
Mc	Mercer silt loam, eroded rolling phase	Not prime farmland	0	2.2	0.2%
Me	Mountview silt loam, 2 to 5 percent slopes	All areas are prime farmland	0	4.5	0.4%
Mf	Mountview silt loam, eroded undulating phase	All areas are prime farmland	0	0.3	<0.1%
Mg	Mountview silt loam, 5 to 12 percent slopes	Not prime farmland	0	3.5	0.3%
Mh	Mountview silt loam, eroded rolling phase	Not prime farmland	0	6.8	0.6%
Mk	Mountview silt loam, rolling shallow phase	Not prime farmland	0	24.5	2.2%
Ml	Mountview silt loam, eroded, rolling shallow phase	Not prime farmland	0	24.7	2.2%
Mm	Mountview silt loam, hilly shallow phase	Not prime farmland	0	10.0	0.9%
Mn	Mountview silt loam, eroded hilly shallow phase	Not prime farmland	0	25.1	2.2%
MnC	Minvale gravelly silt loam, 5 to 12 percent slopes	Farmland of local importance	0	16.8	1.5%
Mo	Mountview silty clay loam, severely eroded rolling phase	Not prime farmland	0	1.5	0.1%
Mp	Mountview silty clay loam, severely eroded rolling shallow phase	Not prime farmland	0	1.5	0.1%
Mr	Mountview silty clay loam, severely eroded hilly shallow phase	Not prime farmland	0	5.8	0.5%
MtC2	Mountview silt loam, 5 to 12 percent slopes, eroded	Farmland of local importance	0	10.3	0.9%
No	Nolin silt loam, occasionally flooded	All areas are prime farmland	0	6.2	0.6%
Oa	Newark silt loam, occasionally ponded	Prime farmland if drained and either protected from	0	<0.1	<0.1%

Soil Map Unit Symbol	Soil type	Farmland classification	Hydric Rating	Area (acres)	Percentage of area
		flooding or not frequently flooded during the growing season			
Pa	Paden silt loam, eroded undulating phase	All areas are prime farmland	0	3.0	0.3%
Pb	Paden silt loam, eroded rolling phase	Not prime farmland	0	2.7	0.2%
Pd	Pickwick silt loam, undulating phase	All areas are prime farmland	0	4.0	0.4%
Pe	Pickwick silt loam, eroded undulating phase	All areas are prime farmland	0	6.7	0.6%
Pf	Byler silt loam, 5 to 12 percent slopes, eroded	Not prime farmland	0	4.3	0.4%
Pf	Pickwick silt loam, eroded rolling phase	All areas are prime farmland	0	6.4	0.6%
Pk	Armour silt loam, 2 to 5 percent slopes, eroded	All areas are prime farmland	0	3.5	0.3%
Ra	Robertsville silt loam	Not prime farmland	100	1.6	0.1%
Rc	Rock outcrop, very steep	Not prime farmland	0	5.5	0.5%
Rf	Sengtown-Rock outcrop complex, 20 to 60 percent slopes	Not prime farmland	0	4.6	0.4%
SeC	Sengtown gravelly silt loam, 5 to 12 percent slopes	Farmland of local importance	0	203.6	18.1%
SeC	Sengtown gravelly silt loam, 5 to 12 percent slopes	Not prime farmland	0	7.5	0.6%
SeD	Sengtown gravelly silt loam, 12 to 20 percent slopes	Not prime farmland	0	177.4	15.8%
SeF	Sengtown gravelly silt loam, 30 to 60 percent slopes	Not prime farmland	0	212.5	18.9%
Su	Sullivan silt loam, occasionally flooded	All areas are prime farmland	0	4.6	0.4%
Ta	Taft silt loam, 0 to 2 percent slopes	All areas are prime farmland	4	0.8	0.1%
Tb	Talbott-Pickwick silt loam, eroded rolling phase	Not prime farmland	0	9.5	0.8%
Tc	Tigrett silt loam	All areas are prime farmland	0	3.7	0.3%
W	Water	Not prime farmland	0	1.6	0.1%
	Total Farmland of Local Importance			**230.7**	**20.5%**
	Total Prime Farmland			**195.4**	**17.4%**

Source: USDA 2019b

3.5.1.1.3. Alternative B

3.5.1.1.3.1. Johnsonville Reservation

Geology

The Johnsonville Reservation lies in the Western Highland Rim Physiographic Province of Tennessee which is characterized by rolling hills and incised valleys. Underlying bedrock of the region is chiefly Mississippian to Ordovician-age limestone, chert, shale, siltstone and sandstone (Luther 2018; Griffith et al. 1997). The Project site is primarily underlain by alluvial deposits of the Tennessee River which are characterized by sand, silt, clay, and gravel between 20 and 60 feet thick. Portions of the Project site are underlain by the Fort Payne Formation and Chattanooga Shale. The Fort Payne Formation is characterized by bedded chert, calcareous, and dolomitic sandstone with minor lenses of limestone and shale with an average thickness of 250 feet. The Chattanooga Shale is characterized as black carbonaceous shale and fissile with an average thickness of 20 feet (Greene and Wolfe 2000; Hardeman et al. 1966).

Paleontology

The paleontology associated with the Johnsonville Reservation is generally the same as described in Section 3.5.1.1.1.

Geological Hazards

The geological hazards associated with the Johnsonville Reservation are generally the same as described in Section 3.5.1.1.1. The site is currently developed and generally located on low undulating terrain. No significant slopes are present within several miles; therefore, landslides are not a potential risk. Hazards resulting from geological conditions may be encountered in the case of sinkholes. Central Tennessee is located over predominantly limestone bedrock that is susceptible to erosion and the creation of sinkholes; therefore, the Johnsonville Reservation has a minimal to moderate risk for sinkholes.

Soils

Four soil types have been mapped on the 106-acre proposed CT plant site on the Johnsonville Reservation and the majority are composed of Paden silt loam, eroded (79.1 percent) and Melvin silty clay loam (10.6 percent); and Paden silt loam (8.8 percent); the Wolftever silty clay loam comprises less than one percent (USDA 2019b), as summarized in Table 3.5-4 and illustrated in Figure 3.5-6. The Melvin silty clay loam soil has a hydric rating of 100 percent.

The Paden series soils consist of very deep, moderately well drained soils with a fragipan in the subsoil that formed in silty material and the underlying older alluvium or residuum. These soils are on stream terraces with slopes ranging from zero to 12 percent. These soils are used for growing cotton, corn, soybeans, hay, and pasture. The Melvin series soils consist of very deep, poorly drained soils formed in silty alluvium. These soils are on floodplains and in upland depressions with slopes ranging from zero to two percent. These soils, where previously drained, are used for corn, sorghum, soybeans, and hay (USDA 2021).

Prime Farmland

Based on soils data obtained from the USDA Web Soil Survey, approximately 10.1 acres (9.5 percent) of the proposed CT plant site are designated as prime farmland, as illustrated in Figure 3.5-7. However, all of these areas classified as prime farmland are previously disturbed and developed and therefore do not retain their original prime farmland characteristics.
Table 3.5-3 describes the soil types, including those classified as prime farmland, located on the proposed CT plant site.

Table 3.5-4. Soils on the proposed CT plant site on the JCT Reservation

Soil Map Unit Symbol	Soil type	Farmland classification	Hydric Rating	Area (acres)	Percentage of area
Mc	Melvin silty clay loam	Not prime farmland	100	11.2	10.6%
Ps	Paden silt loam	All areas are prime farmland	0	9.4	8.8%
Psr	Paden silt loam, eroded	Not prime farmland	0	83.8	79.1%
W	Water	Not prime farmland	0	0.9	0.8%
Wcc	Wolftever silty clay loam, compact	All areas are prime farmland	0	0.7	0.7%
Total Prime Farmland				10.1	9.5%

Source: USDA 2019b

Figure 3.5-6. Soils on the proposed CT plant site on the Johnsonville Reservation

Figure 3.5-7. Soils classified as prime farmland on the proposed CT plant site on the Johnsonville Reservation

3.5.1.1.3.2. Gleason Reservation

Geology

The Project site lies in the East Gulf Coastal Plain Physiographic Province of Tennessee which is characterized by Tertiary-age sand, silt, clay, and gravel. The Project site is primarily underlain by loess of the Quaternary age which is characterized by gray to brown clayey and sandy silt with a maximum thickness of 100 feet (Greene and Wolfe 2000; Hardeman et al. 1966).

Paleontology

The paleontology associated with the Gleason Reservation is generally the same as described in Section 3.5.1.1.1.

Geological Hazards

The geological hazards associated with the Gleason Reservation are generally the same as described in Section 3.5.1.1.1. The reservation is currently developed where the plant and associated infrastructure exist, and the remaining area is generally undeveloped and located on low undulating terrain. No significant slopes are present within several miles; therefore, landslides are not a potential risk. The Gleason Reservation is located near the New Madrid Seismic Zone, as described in Section 3.5.1.1.1. Karst conditions are rare in west Tennessee, and it is unlikely that sinkhole activity or subsidence would present a risk.

Soils

Four soil types have been mapped on the 61.6-acre proposed CT plant site on the Gleason Reservation. They are composed of Waverly, Rosebloom silt loams and frequently flooded soils (48.4 percent); Routon silt loam, zero to two percent slopes (27.2 percent); Falaya silt loam, zero to two percent slopes, occasionally flooded, brief duration (24.4 percent); and Lexington silt loam, two to five percent slopes, moderately eroded (less than 0.1 percent) (USDA 2019a; Table 3.5-5, Figure 3.5-8). The Routon silt loam soil has a hydric rating of 100 percent; the Waverly, Rosebloom silt loams have a hydric rating of 66 to 99 percent;, and the Falaya silt loam soil has a hydric rating of one to 33 percent.

The Waverly series soils consist of nearly level, very deep, poorly drained, moderately permeable soils that formed in silty alluvium derived from loess. These soils are on floodplains and alluvial fans with slopes ranging from zero to two percent. These soils are used for growing cotton, corn, soybeans, hay crops, or pasture. The Rosebloom series soils consist of deep, poorly drained soils that formed in silty alluvium. These soils are on floodplains with slopes ranging from zero to two percent. These soils are used for pasture or for growing soybeans, hay, or cotton. The Routon series soils consist of very deep, poorly drained, slowly permeable soils that formed in silty alluvium derived from loess. These soils are on low stream terraces and in depressions on uplands with slopes ranging from zero to three percent. These soils are used for pasture or for growing soybeans, corn, milo, and cotton. The Falaya series soils consist of very deep, somewhat poorly drained, moderately permeable soils that formed in silty alluvium from loess. These soils are on level to nearly level wide floodplains with slopes ranging from zero to two percent. These soils are used for growing corn, cotton, soybeans, small grains, pasture, and hay (USDA 2021).

Prime Farmland

Based on soils data obtained from the USDA Web Soil Survey, approximately 15.0 acres (24.4 percent) of the proposed CT plant site are designated as prime farmland if drained (Falava silt

loam), as illustrated in Figure 3.5-9. Table 3.5-5 describes the soil types, including those classified as prime farmland, located on the proposed CT plant site.

Table 3.5-5. Soils on the proposed CT plant site on the Gleason Reservation

Soil Map Unit Symbol	Soil type	Farmland classification	Hydric Rating	Area (acres)	Percentage of area
Fb	Falaya silt loam, 0 to 2 percent slopes, occasionally flooded, brief duration	Prime farmland if drained	5	15.0	24.4%
LeB2	Lexington silt loam, 2 to 5 percent slopes, moderately eroded	All areas are prime farmland	0	<0.1	<0.1%
Rt	Routon silt loam, 0 to 2 percent slopes	Not prime farmland	100	16.8	27.2%
WR	Waverly, Rosebloom silt loams and frequently flooded soils	Not prime farmland	90	29.8	48.4%
	Total Prime Farmland			**15.0**	**24.4%**

Source: USDA 2019b

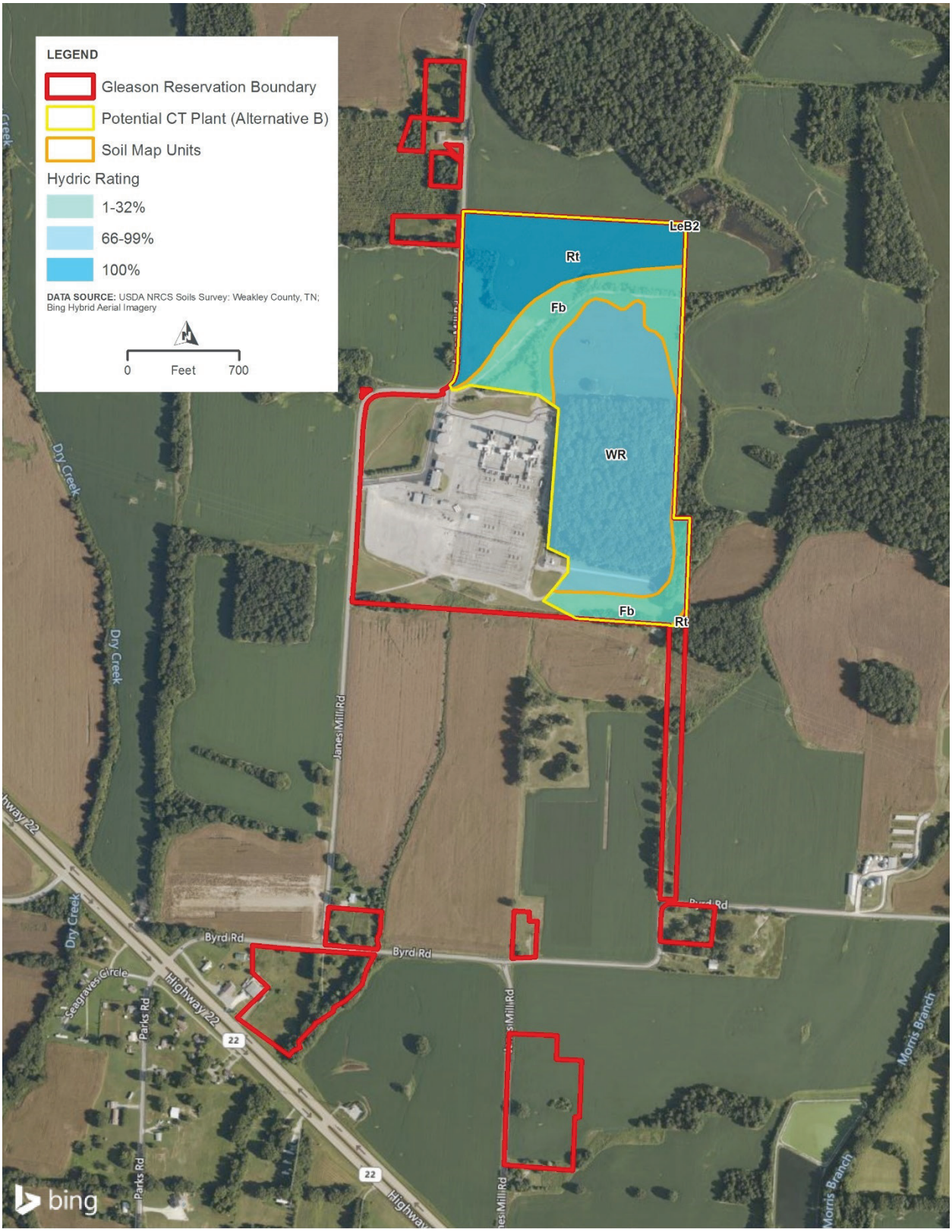

Figure 3.5-8. Soils on the proposed CT plant site on the Gleason Reservation

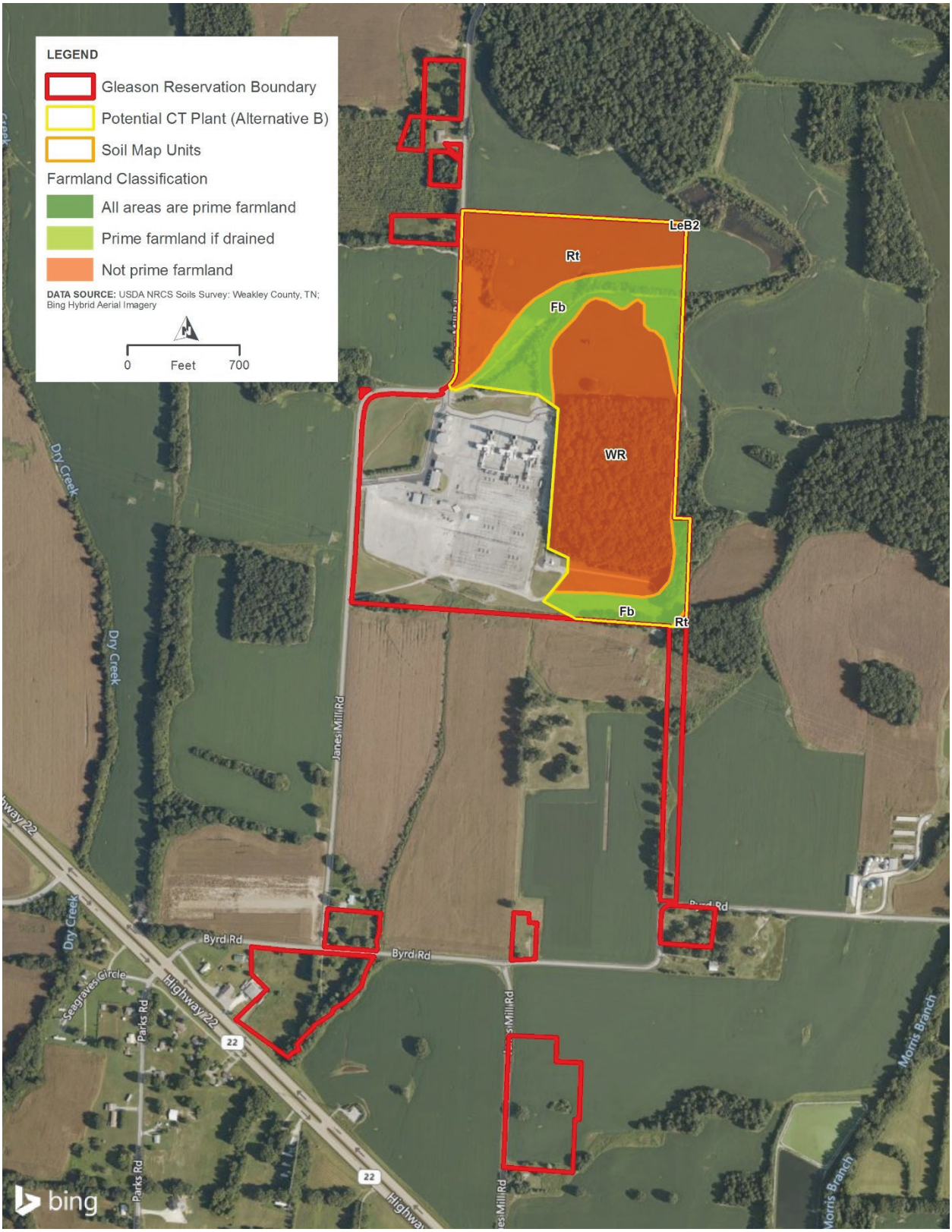

Figure 3.5-9. Soils classified as prime farmland on the proposed CT plant site on the Gleason Reservation

3.5.1.1.3.3. Transmission Corridors

TVA would construct a new approximately 40-mile, 500-kV TL from Weakley to a new station on the Marshall-Cumberland 500-kV TL. For a full list of transmission and electrical system components associated with Alternative B, see Table 2.1-4.

Geology

The transmission corridor lies in the East Gulf Coastal Plain Physiographic Province of Tennessee which is characterized by Tertiary-age sand, silt, clay, and gravel. The transmission corridor is primarily underlain by loess of the Quaternary age which is characterized by gray to brown clayey and sandy silt with a maximum thickness of 100 feet (Greene et al.. 2000; Hardeman et al. 1966).

Paleontology

The paleontology associated with the proposed 40-mile transmission corridor is generally the same as described in Section 3.5.1.1.1.

Geological Hazards

The proposed transmission corridor in Alternative B is located on low undulating terrain. No significant slopes are present within several miles; therefore, landslides are not a potential risk. No volcanoes are present within several hundred miles of the corridor. The transmission corridor is located near the New Madrid Seismic Zone as described in Section 3.5.1.1.1. Karst conditions are rare in west Tennessee and it is unlikely that sinkhole activity or subsidence would present a risk.

Soils

Based on soils data obtained from the USDA Web Soil Survey, the majority of the soils in the transmission corridor are mapped as Loring, Smithdale, Falaya, Feliciana, and Collins series soils. The Loring series soils consist of moderately well drained soils with a fragipan that formed in loess. These soils are on level to strongly sloping uplands and stream terraces with slopes ranging from zero to 20 percent. These soils are used for growing cotton, small grains, soybeans, hay, and pasture. The Smithdale series soils consist of very deep, well drained, moderately permeable soils that formed in thick beds of loamy marine sediments. These soils are on ridge tops and hill slopes in dissected uplands of the Southern Coastal Plain and in the Western Coastal Plain with slopes ranging from one to 60 percent. These soils are used for growing pasture and a few areas are cropped to corn, cotton, soybeans, and small grains. The Falaya series soils consist of very deep, somewhat poorly drained, moderately permeable soils that formed in silty alluvium from loess. These soils are on level to nearly level wide floodplains with slopes ranging from zero to two percent. These soils are used for growing corn, cotton, soybeans, small grains, pasture, and hay. The Feliciana series soils consist of very deep, well drained, moderately permeable soils that formed in the Peoria loess deposits more than 48 inches in thickness. These soils are on terraces and uplands of the Southern Coastal Plain with slopes ranging from zero to 40 percent. These soils are used for growing soybeans, small grains, hay, and pasture. The Collins series soils consist of very deep, moderately well drained, moderately permeable soils that formed in silty alluvium. These soils are on floodplains of streams in the Southern Mississippi Valley Silty Uplands with slopes ranging from zero to two percent. These soils are used for growing cotton, corn, soybeans, small grains, pasture, and hay crops (USDA 2021).

Prime Farmland

Based on soils data obtained from the USDA Web Soil Survey, approximately 350 acres (36 percent) of the transmission corridor are designated as prime farmland (USDA 2019b).

3.5.1.1.4. Alternative C

3.5.1.1.4.1. Middle Tennessee TVA Power Service Area

TVA anticipates that a portion of the solar facilities proposed under Alternative C would be located in the Middle Tennessee region in order to offset transmission system upgrades that may be required following the retirement of CUF. Power from these facilities would typically be delivered by direct connection to TVA's transmission system or via interconnections with local power companies that distribute power from TVA.

Geology

The solar and storage project sites would be generally located in central Tennessee, which, as defined in Figure 3.5-1, lies within Highland Rim, Nashville Basin, and a very small portion of the Cumberland Plateau physiographic areas.

The Cumberland Plateau lies between the Ridge and Valley and Highland Rim and reaches elevations between 600 to 3,000 feet in elevation. It is comprised of Pennsylvania age conglomerate, sandstone, siltstone, and shale and Mississippian to Ordovician age limestone, dolomite, and shale.

The Highland Rim section is a plateau characterized by rolling hills to flat areas in the northwest and southeast which lies between the Cumberland Plateau and Gulf Coastal Plain. Bedrock in the area is Mississippian limestones, chert, shale and sandstone. Underlying bedrock of the region is chiefly Mississippian to Ordovician-age limestone, chert, shale, siltstone, and sandstone (Luther 2018; Griffith et al. 1997).

The Central Basin has an elevation of approximately 200 feet below the surrounding Highland Rim. Bedrock in the area is flat-lying limestone. Karst is well developed in parts of both the Highland Rim and the Nashville Basin (Greene and Wolfe 2000; Hardeman et al. 1966).

Paleontology

The paleontology associated with central Tennessee is generally the same as described in Section 3.5.1.1.1.

Geological Hazards

Geological hazards can include landslides, volcanoes, earthquakes/seismic activity, and subsidence/sinkholes. No volcanoes are present within several hundred miles of central Tennessee.

Landslides have a higher likelihood in areas with increased slope and decreasing vegetative cover. Landslides can be initiated by rainfall, snowmelt, changes in water level, stream erosion, changes in groundwater, earthquakes, disturbance by human activities, or any combination of these activities.

Sinkholes can occur where the rock below the land surface is a carbonate rock, such as a limestone or dolomite, as well as in salt beds and other rocks that can naturally be dissolved by groundwater circulating through them, such as gypsum. The process typically can take many years to decades to form, and as the rock dissolves, spaces and caverns develop underground. Land over sinkholes may stay intact until there is not enough support for the land above the spaces. Then a sudden collapse of the land surface can occur. These collapses can vary greatly in size and shape (Kaufmann 2007). Depending on selected sites, Alternative C could occur near the New Madrid Seismic Zone, as described in Section 3.5.1.1.1.

Soils
Given the lack of identified potential solar and storage facility sites at this time, it is not possible to provide a detailed description of the soils at potential facility sites at this time. Generally, soils in Middle Tennessee are composed of silty loam textures, with some areas consisting of clays and gravelly sands, and range from somewhat excessively drained to poorly drained.

Prime Farmland
Approximately 23 percent of the Middle Tennessee TVA PSA is classified as prime farmland (USDA 2019b). An additional one percent would be classified as prime farmland if drained or protected from flooding. Trends in recent decades show an increase in developed land, mostly through conversion of farmland.

3.5.1.2. Environmental Consequences

3.5.1.2.1. The No Action Alternative
Under the No Action Alternative, current operations would continue. TVA would implement the planned actions related to the current and future management and storage of CCRs at CUF, which have either been reviewed or will be in subsequent NEPA analysis. There would be no anticipated adverse cumulative effects, either direct or indirect, to geology, soils, or prime farmland.

3.5.1.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant
Under all Action Alternatives, TVA would retire, decommission, deactivate, decontaminate, and deconstruct the CUF units and associated infrastructure. These activities would affect geology and soil resources. Removal of the fossil plant and associated structures with controlled explosives would result in vibrations at the surface in the immediate vicinity of the facility when they are felled. Buildings within the deconstruction boundary would be deconstructed and decontaminated to a depth of three feet below grade, which would generate vibrations throughout the course of deconstruction of the buildings and grading and backfilling of the facility. Due to the small size of the subsurface disturbances and existing industrial development of the site, only minor direct effects to potential subsurface geological resources are anticipated. No adverse cumulative impacts to geology, soils, or prime farmland are anticipated.

3.5.1.2.3. Alternative A
3.5.1.2.3.1. Construction and Operation of CC Plant at CUF

Geology and Paleontology
Under Alternative A, minor effects to geology would occur. Foundations for equipment anticipated for the proposed CC Plant would be excavated. Transmission structures are typically driven or drilled into the ground to shallow depths. Due to the small size of the subsurface disturbances, only minor direct effects to potential subsurface geological resources are anticipated. Should paleontological resources be exposed during site construction (i.e., grading, directional drilling, trenching, and foundation placement) or operation activities, a paleontological expert would be consulted to determine the nature of the paleontological resources, recover these resources, analyze the potential for additional effects, and develop and implement a recovery plan/mitigation strategy.

Geologic Hazards
Based on regional data, the potential for minor seismic activity exists due to Alternative A's proximity to the New Madrid Seismic Zone. The facilities would be designed to comply with applicable seismic standards. In the unlikely event of seismic activity, it would likely cause minor

effects to the Project site and equipment on the site based on construction activities meeting state and federal earthquake/seismic guidelines. No other geologic hazards are anticipated.

Soils

Vegetation clearing, grading, and other site preparation activities associated with the construction of the CC plant have the potential to disturb soil stability and increase erosion. The original CC plant boundary (Option A2) would occupy approximately 30 acres, and an additional 10 to 20 acres on site would be used for equipment laydown and mobilization. Subsurface piles or other deep foundation systems would be installed to support foundations for plant components, as required.

The revised design for the CC plant and TL upgrades would result in temporary impacts to 49 acres and permanent impacts to 147 acres. 56 of those acres are permanent impacts associated with the CC plant, and 91 of those acres are permanent habitat conversion associated with TL upgrades (Figure 3.5-4).

TL upgrades may require improvements to existing access roads and may also require replacing TL structures. Minimal ground disturbance is expected in these areas, but if the ground is disturbed, the access road area would be revegetated using native, low-growing plant species after required TL upgrade work is completed to minimize the potential for increased soil erosion and runoff.

Effects to soils associated with grading and site preparation activities would be temporary and mitigated through BMPs identified in Section 2.3. Stockpiled soils from the area where vegetation clearing and grading occurs, including topsoil, would be appropriately replaced following cut-and-fill activities to the extent practical and, therefore, would likely not require any off-site or on-site hauling of soils. However, some minimal off-site or on-site hauling may be necessary.

Although not anticipated, should borrow material be required for project site activities, sand and gravel aggregate may be obtained from local, permitted, off-site sources. The creation of new impervious surface, in the form of the CC plant facility and associated components, would result in a minor increase in stormwater runoff and potential increase in soil erosion. Operation of the CC plant would not affect soils. No adverse cumulative impacts to soils are anticipated.

Prime Farmland

Based on soils data obtained from the USDA Web Soil Survey, there are a total of approximately 53 acres of prime farmland with the potential to be impacted by the proposed CC plant (Table 3.5-2). Within a five-mile radius of the CC plant site, approximately 12,562 acres (21.3 percent) have soils classified as prime farmland. Any minor loss of on-site prime farmland soils is not significant when compared to the amount of prime farmland within the surrounding region. Effects on nearby prime farmland soils would be reduced using appropriate BMPs to control erosion and limit sediment and soil from leaving the CC plant site.

The Alternative A transmission line upgrade activities could result in minor effects to prime farmland. Upgrades are typically performed to increase the electrical capacity of the existing TLs and would include the items listed in Section 2.1.3.2.2. Minimal ground disturbance is expected in these areas, but if the ground is disturbed, the access road area would be revegetated using native, low-growing plant species after required TL upgrade work is completed to minimize the potential for increased soil erosion and runoff. Areas such as pasture, agricultural fields, or lawns would be returned to their former condition. Since the exact

locations and acreage of the TL upgrade activities are not known at this time, TVA compiled the list of typical effects from construction activities related to transmission projects presented in Table 3.3-1. The review determined that TL construction did not result in prime farmland conversion while 64 percent of new substation and switching station construction resulted in prime farmland conversion. TL upgrade activities resulted in no prime farmland conversions and an average of 6.9 acres (ranging from zero to 29.1 acres) of prime farmland were used for new substation and switching stations. No adverse cumulative impacts to prime farmland are anticipated.

3.5.1.2.3.2. Construction and Operation of Natural Gas Pipeline

Geology and Paleontology

Under Alternative A, minor effects to geology could occur. The 32-mile natural gas pipeline lateral would be buried through a combination of trenching, boring, and directional drilling. Minor direct effects to potential subsurface geological resources are anticipated. The Project is not anticipated to impact known paleontological resources. “In the event unique paleontological resources (e.g., fossilized vertebrate remains such as bones, teeth, etc.) are encountered during pipeline construction, TGP will contact the Tennessee Geological Survey and the FERC to identify and document the specimens and to provide further guidance as to their recovery, as warranted” (TGP 2022f).

Geologic Hazards

Based on regional data, the potential for minor seismic activity exists due to the proposed pipeline’s proximity to the New Madrid Seismic Zone. The pipeline would be designed to comply with applicable seismic standards. In the unlikely event of seismic activity, it would likely cause minor damage to the pipeline corridor and equipment on the site based on construction compliance with state and federal earthquake/seismic guidelines. Karst terrain could affect portions of the pipeline but is unlikely to affect the entire corridor. No other effects from geologic hazards are anticipated.

TGP would “install temporary trench plugs and temporary slope breakers on slopes greater than 5 percent (TGP 2022f). The temporary slope breakers would channel water off the ROW through a J-hook or other baffling device to limit water flow down long steep slopes. Temporary trench plugs would reduce the velocity of water flowing along the trench and volume of water that collects at bottoms of slopes. In accordance with FERC’s Upland Erosion Control, Revegetation, and Maintenance Plan, TGP would install permanent trench breakers and permanent slope breakers in areas of steep slopes. Trench breakers are designed to prevent uneven water flow along the pipeline trench by diverting subsurface flow to the land surface. Groundwater discharging to the land surface is then directed off the ROW by slope breakers which are installed on all slopes greater than 5 percent. Used in combination, these structures prevent subsurface piping of soils that can lead to slope instability and failure.

According to TGP Resource Report 6 (TGP 2022f):

> Ground subsidence could occur in areas [with the potential for] karst development. The structural integrity of a pipeline greatly reduces the probability that a sinkhole would impact the integrity of the pipeline. Allowable span lengths that would prevent over-stressing of the steel pipe depends on pipe diameter, wall thickness, and soil conditions. TGP would routinely monitor the geotechnical integrity of the [pipeline corridor] as part of its operations and maintenance activities for its pipeline system. […] Potential impacts to the geotechnical integrity of the pipeline from karst would be identified, and any necessary corrective actions immediately

> implemented to ensure the safe operation of the pipeline. Localized settling or possible "cracking" of the soil in or near potential karst features would be observed and noted during inspections. If required, maintenance work would be performed to correct the situation by re-grading, adding additional soil, or other means of mitigating the sinkhole.

Controlled blasting would not be used during pipeline construction in areas with karst-prone geology (TGP 2022f).

With the mitigation measures identified and discussed in this section and in Section 2.3 and adherence to U.S. DOT and FERC regulations, "it is not anticipated that the pipeline would significantly impact geologic resources. Like most projects that do not exploit geologic resources or require a specific geologic setting to support the project need, the [pipeline] would have no measurable effect on the local geology. […] Based on the minimal impact from Alternative A in the overlapping footprint and construction timeframe, TGP has determined there are no cumulative impacts associated with geologic hazards. […] For the pipeline to contribute to a cumulative impact on geological resources, other projects or actions would need to involve excavation or significant grading in an area that overlaps the active construction footprint of the pipeline within the same timeframe" (TGP 2022f). TVA does not plan to excavate or grade in areas that would overlap active pipeline construction footprints during the same timeframe, and does not anticipate cumulative impacts to geological resources.

No geologic resources or wells identified within 0.25 mile of the pipeline workspaces would be impacted. The identified resources are past producers or prospects where expansion of the identified resource is precluded by roads, waterbodies, property boundaries, and/or existing utilities and pipelines. "Because oil and gas are generally produced from depths of more than 1,000 feet, construction of the [pipeline] is not expected to affect the ability of the wells to produce oil and/or natural gas. Therefore, no cumulative impacts [from the pipeline are anticipated] on geologic resources, including mining and mineable resources" (TGP 2022f). TVA has evaluated Alternative A and concurs that no cumulative impacts to geologic resources are anticipated.

Soils

Construction activities associated with the pipeline such as clearing, grading, trench excavation, installation, backfilling, and the movement of construction equipment along its route have the potential to disturb soil stability and increase erosion.

Effects to soils associated with grading and site preparation activities would be temporary and mitigated through BMPs identified in Section 2.3. Stockpiled soils from the area where vegetation clearing and grading occurs, including topsoil, would be appropriately replaced following cut-and-fill activities to the extent practical and would likely not require any off-site or on-site hauling of soils. However, some minimal off-site or on-site hauling may be necessary. Operation of the pipeline would not affect soils. No adverse cumulative impacts to soils are anticipated.

As stated in TGP's Resource Report 7 (TGP 2022g):

> In March 2022, TGP consulted with the NRCS regarding approved seed mixes, planting densities, and application rates for vegetation cover types present in the [pipeline] area. […] The NRCS responded with seed mix recommendations, which include species used by pollinators for various types of habitats. If applicable, and

> with landowner permission, TGP would utilize these recommendations during reseeding after construction. The NRCS recommended mulching to improve the efficiency of moisture management, prevent excessive bank erosion from water conveyance channels, reduce concentrated flow erosion, and reduce sheet, rill, and wind erosion. Areas of steep slopes […] would require the use of specific measures to prevent soil erosion during and after construction. […] During construction, temporary cut slopes and excavation walls would be sloped to safe angles based on the strength of the subsurface material or benched to avoid failures and instability.

Prime Farmland

Approximately 38 percent of the proposed gas pipeline would be located on prime farmland soils. The greatest impact on prime farmland typically occurs where agricultural practices are active. Potential impacts include soil erosion, interference with and damage to agricultural surface and sub-surface drainage systems and irrigation systems, the mixing of topsoil and subsoil, the potential loss of fertile topsoil, and topsoil compaction. If drainage tiles are exposed or damaged during construction activities, appropriate measures to repair or replace the drainage tiles would be implemented after coordination with the affected landowner and in accordance with applicable regulatory guidelines. Topsoil would be removed or stripped and segregated in agricultural lands that are regularly cultivated. In addition, soils in agricultural lands would be de-compacted as necessary, and rocks would be removed following the installation of the pipeline. While most impacts to designated farmland soils by the proposed pipeline are limited to the construction phase and considered relatively minor and short term, the small 0.02-acre site of the Cumberland meter station, which is not currently farmed, would be removed from potential agricultural production. The limited loss of prime farmland soil associated with the Cumberland meter station would have a minimal impact on the overall availability of prime farmland.

The construction of the natural gas pipeline combined with RFFAs in the vicinity of the CUF Reservation and proposed pipeline corridor, listed in Table 3.1-1, could remove current prime farmland in the area, resulting in minor cumulative impacts on prime farmland.

3.5.1.2.3.3. Summary of Alternative A

In sum, minor direct effects to potential subsurface geological resources are anticipated from the construction of the CC Plant and pipeline due to subsurface activities. No geologic resources identified within 0.25 mile of the pipeline workspaces will be impacted. Mitigation measures would be utilized in karst-prone or sloped areas to reduce the risk of geologic hazards and impacts during pipeline construction. Vegetation clearing, grading and other site preparation activities associated with the construction of the CC plant have the potential to disturb soil stability and increase erosion. The revised design of the CC plant and TL upgrades would result in temporary impacts to 49 acres and permanent impacts to 147 acres. 56 of those acres are permanent impacts associated with the CC plant, and 91 of those acres are permanent habitat conversion associated with TL upgrades (Figure 3.5-4). There would be a minor, permanent effect to 0.2 acres of prime farmland from the construction of the Cumberland meter station. Effects to soils associated with grading and site preparation activities from pipeline construction would be temporary and mitigated through BMPs identified in Section 2.3.

3.5.1.2.3.4. Environmental Justice Considerations

Effects to prime farmland resources as a result of construction of the natural gas pipeline lateral may have temporary, minor adverse effects on populations that currently farm the corridor where the pipeline would be constructed. Such effects would occur where farming populations

and prime farmland soils co-exist. These effects may be amplified on farming EJ populations since approximately 71 percent of the prime farmland or farmland of local importance are in EJ areas, and these low-income and minority populations may be more vulnerable to temporary farmland loss. Impacts on farming populations are analyzed in Section 3.4.2.3.2. Construction of the pipeline will not have amplified effects on EJ populations located in prime farmland areas.

3.5.1.2.4. Alternative B

3.5.1.2.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Geology and Paleontology

Under Alternative B, minor effects to geology could occur. Foundations for equipment anticipated for the CT plant at JCT would be excavated. Transmission structures are typically driven or drilled into the ground to shallow depths. Minor excavations would also be required for construction of a substation and other transmission components. Due to the small sizes of the subsurface disturbances, only minor direct effects to potential subsurface geological resources are anticipated.

Should paleontological resources be exposed during site construction (i.e., grading and foundation placement) or operation activities, a paleontological expert would be consulted to determine the nature of the paleontological resources, recover these resources, analyze the potential for additional effects, and develop and implement a recovery plan/mitigation strategy.

Geologic Hazards

Based on regional data, the potential for minor seismic activity exists due to the proximity of the CT plant to the New Madrid Seismic Zone. The CT plant at JCT would be designed to comply with applicable seismic standards. In the unlikely event of seismic activity, it would likely cause minor effects to the site. No other geologic hazards are anticipated.

Hazards resulting from geological conditions may be encountered in the case of sinkholes. Central Tennessee is located over limestone bedrock that is susceptible to erosion and the creation of sinkholes. Based on the finalized location of the transmission corridor, sinkholes could be a minimal to moderate risk.

Soils

Grading and site preparation activities associated with the construction of the CT plant have the potential to disturb soil stability and increase erosion. The CT plant would occupy less than 10 acres. Approximately 33 acres from previous projects, inclusive of temporary use area, could be designated for light uses, such as trailer placement or light vehicle parking, during construction. While this area would be newly disturbed, when construction is complete, it would be allowed to revert to its original use.

Effects to soils associated with grading and site preparation activities would be temporary and mitigated through BMPs identified in Section 2.3. Any stockpiled soils from the area where vegetation clearing and grading occurs, including topsoil, would be appropriately replaced following cut-and-fill activities to the extent practical and, therefore, will likely not require any off-site or on-site hauling of soils. However, some minimal off-site or on-site hauling may be necessary.

Although not anticipated, should borrow material be required for project site activities, small amounts of sand and gravel aggregate may be obtained from local, off-site sources. The creation of new impervious surface, in the form of the CT plant facility and associated

components, would result in a minor increase in stormwater runoff and potential increase in soil erosion. Operation of the CT plant would not affect soils. No adverse cumulative impacts to soils are anticipated.

Prime Farmland
Based on soils data obtained from the USDA Web Soil Survey, there are a total of approximately 10.1 acres of prime farmland within the proposed CT plant site. However, the proposed CT plant site is currently disturbed and developed land. Within a five-mile radius of the CT plant site, approximately 12,746.5 acres (22.5 percent) have soils classified as prime farmland. Any minor loss of on-site prime farmland soils is not significant when compared to the amount of prime farmland within the surrounding region and it should be noted that these on-site soils classified as prime farmland are previously disturbed and developed; therefore, they do not retain their original prime farmland characteristics. Therefore, the construction and operation of the CT plant under Alternative B would result in negligible effects to prime farmland. Effects on prime farmland soils would be reduced using appropriate BMPs and properly engineered storm water management to control erosion and limit sediment and soil from leaving the CT plant site. No cumulative impacts to prime farmland are anticipated.

3.5.1.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

Geology and Paleontology
Under Alternative B, minor effects to geology could occur at Gleason and would be comparable to those described for the JCT Reservation in Section 3.5.1.2.4.1.

Geologic Hazards
Under Alternative B, the potential for minor seismic activity exists at Gleason and would be comparable to that described for the JCT Reservation in Section 3.5.1.2.4.2.

Soils
Grading and site preparation activities associated with the construction of the CT plant have the potential to disturb soil stability and increase erosion. The CT plant would occupy less than 10 acres. There are 60 acres available on the Gleason site for laydown and temporary use areas that are currently undeveloped. While this area would be newly disturbed, when construction is complete, it would be allowed to revert to its original use.

Effects to soils associated with grading and site preparation activities would be temporary and mitigated through BMPs identified in Section 2.3. Any stockpiled soils from the area where vegetation clearing and grading occurs, including topsoil, would be appropriately replaced following cut-and-fill activities to the extent practical and, therefore, will likely not require any off-site or on-site hauling of soils. However, some minimal off-site or on-site hauling may be necessary.

Borrow material may be required for project site activities, including sand and gravel aggregate, which may be obtained from local, permitted off-site quarries or sources. The creation of new impervious surface, in the form of the CT plant facility and associated components, would result in a minor increase in stormwater runoff and potential increase in soil erosion. Operation of the CT plant would not affect soils. No adverse cumulative impacts to soils are anticipated.

Prime Farmland
Based on soils data obtained from the USDA Web Soil Survey, there are a total of approximately 15.0 acres of prime farmland with the potential to be impacted by the proposed CT plant. Within a five-mile radius of the CT plant site, approximately 22,840 acres (41.7

percent) have soils classified as prime farmland. Any minor loss of on-site prime farmland soils is not significant when compared to the amount of prime farmland within the surrounding region and it should be noted that these on-site soils classified as prime farmland are previously disturbed and developed; therefore, they do not retain their original prime farmland characteristics. Therefore, the construction and operation of the CT plant under Alternative B would result in negligible effects to prime farmland. Effects on prime farmland soils would be reduced using appropriate BMPs to control erosion and limit sediment and soil from leaving the CT plant site. No adverse cumulative impacts to prime farmland are anticipated.

3.5.1.2.4.3. Transmission and Other Components

Geology and Paleontology
Under Alternative B, minor effects to geology could occur. Transmission structures are typically driven or drilled into the ground to shallow depths. Minor excavations would also be required for construction of a substation and other transmission components. Due to the small sizes of the subsurface disturbances, only minor direct effects to potential subsurface geological resources are anticipated.

Should paleontological resources be exposed during site construction (i.e., grading and foundation placement) or operation activities, a paleontological expert would be consulted to determine the nature of the paleontological resources, recover these resources, analyze the potential for additional effects, and develop and implement a recovery plan/mitigation strategy.

Geologic Hazards
Based on regional data, the potential for minor seismic activity exists due to the proximity of the 40-mile transmission line to the New Madrid Seismic Zone. The transmission line would be designed to comply with applicable seismic standards. In the unlikely event of seismic activity, it would likely cause minor effects the site. No other geologic hazards are anticipated.

Hazards resulting from geological conditions may be encountered in the case of sinkholes. Central Tennessee is located over limestone bedrock that is susceptible to erosion and the creation of sinkholes. Based on the finalized location of the transmission corridor, sinkholes could be a minimal to moderate risk.

Soils
The 40-mile transmission line would have minor effects on soils. While an exact route is not known, minimal ground disturbance is expected in these areas and the area would be revegetated using native, low-growing plant species after required TL work is completed to minimize the potential for increased soil erosion and runoff. Areas such as pasture, agricultural fields, or lawns could be returned to their former condition. The exact locations and acreage of the TL route are not known at this time. Based on the standard ROW width of 175 feet for a 500-kV TL, the 40-mile line would have a footprint of about 850 acres with additional area required for the substation. Effects to soils associated with TL work would be temporary and mitigated through BMPs identified in Section 2.3. No adverse cumulative impacts to soils are anticipated.

Prime Farmland
A 40-mile transmission line would have minimal permanent effects on prime farmland because of the nature of the activities associated with construction and operation of transmission lines. While the exact route is not known, minimal ground disturbance is expected in these areas and the area would be revegetated using native, low-growing plant species after required TL work is

completed to minimize the potential for increased soil erosion and runoff. Areas such as pasture, agricultural fields, or lawns could be returned to their former condition. Given the location of the transmission line and associated substation in a heavily agricultural area, it is likely that a large portion of the 850+ acres would occur on prime farmland. Any prime farmland on the substation site would be converted to an industrial land use. The construction and operation of the transmission line would not result in prime farmland conversion. No adverse cumulative impacts to prime farmland are anticipated.

3.5.1.2.5. Alternative C

3.5.1.2.5.1. Construction and Operation of Solar and Storage Facilities

Geology and Paleontology

Under Alternative C, minor effects to geology could occur from the construction of solar and storage facilities. The solar arrays would be supported by steel piles, which would either be driven or drilled into the ground to a depth of seven to 15 feet. On-site sedimentation basins would be installed as needed or required by permit. The PV panels would be connected with underground wiring placed in trenches approximately three- to four-feet deep. Minor excavations would also be required for construction of the facility substations, each medium voltage transformer, and the concrete pads for the storage systems.

Geologic Hazards

Landslides are possible in areas of increased slopes and decreased vegetative cover. Landslide potential would be evaluated prior to construction of Alternative C, and solar components would not be built in areas subject to landslides. Hazards resulting from geological conditions may be encountered in the case of sinkholes. Central Tennessee is located over limestone bedrock that is susceptible to erosion and the creation of sinkholes. Based on the finalized location of the solar and storage facilities and associated transmission lines, sinkholes could present a minimal to moderate risk.

Based on regional data, the potential for minor seismic activity exists due to Alternative C's proximity to the New Madrid Seismic Zone. The solar and storage facilities and transmission lines would be designed to comply with applicable seismic standards. In the unlikely event of seismic activity, it would likely cause only minor effects to the project sites and equipment on the sites based on construction compliance with state and federal earthquake/seismic guidelines.

Soils

Under Alternative C, the construction and operation of 3,000 MW of solar and 1,700 MW of battery storage at various sites largely within the Middle Tennessee region would result in minor effects to soils. Since the exact project locations for solar and/or storage projects are not known at this time, according to the analysis described in Section 3.2, an average of 7.3 acres (ranging from 2.00 to 17.95 acres per MW) are typically required for PV projects. Based on this average acreage requirement, the 3,000 MW of solar generating capacity would occupy about 21,900 acres. Soil impacts would be spread across 30 solar sites in the Middle Tennessee region, based on the assumption that each site is 100 MW. Approximately 10 to 15 acres per 40 MW would be required for the storage facilities. Based on this requirement, the 1,700 MW of battery storage would occupy about 425 to 638 acres.

Grading and clearing activities associated with the construction of the solar and battery storage facilities would cause minor, localized increases in erosion and sedimentation, resulting in minor effects to soils. Effects to soils associated with grading and clearing activities would be temporary and mitigated through BMPs identified in Section 2.3. Soils would be temporarily

affected due to construction activities and tree-trimming and other maintenance activities during operation. Any stockpiled soils from the area where vegetation clearing and grading occurs, including topsoil, would be appropriately replaced following cut-and-fill activities to the extent practical and, therefore, will likely not require any off-site or on-site hauling of soils. However, some minimal off-site or on-site hauling may be necessary.

Although not anticipated, should borrow material be required for project site activities, small amounts of sand and gravel aggregate may be obtained from established local, off-site sources. The creation of new impervious surface, in the form of the foundations for the central inverters, BESS, and other associated components, would result in a minor increase in stormwater runoff and potential increase in soil erosion. Planting of native and/or non-invasive vegetation, including plants attractive to pollinators, within the limits of disturbance, along with use of BMPs identified in Section 2.3, would minimize the potential for increased soil erosion and runoff. Following construction, implementation of soil stabilization and vegetation management measures would reduce the potential for erosion effects during site operations. No adverse cumulative impacts to soils are anticipated.

During operation and maintenance of the solar facilities, minor disturbance could occur to soils. Routine maintenance would include periodic motor replacement; inverter air filter replacement; fence repair; vegetation control; and periodic PV array inspection, repairs, and maintenance. The individual solar facilities could utilize mowing or grazing sheep to manage vegetation within portions of the fenced-in, developed areas not limited by other constraints. Additional fencing for the sheep would be used to limit their movement and manage vegetation growth. Selective spot applications of herbicides may be employed around facilities and structures to control weeds. Herbicides would be applied by a professional contractor or a qualified project technician. These maintenance activities would not result in any adverse effects to soils on the project sites during operations.

Prime Farmland

Under Alternative C, the construction and operation of 3,000 MW of solar and 1,700 MW of battery storage largely at sites within the Middle Tennessee region could result in temporary moderate effects to prime farmland. TVA typically utilizes 20- to 25-year PPAs with third-party developers for its solar facilities, but also has the option to “self-build” solar facilities. At the end of a PPA, the developer would assess whether to cease operations at the solar facility or to replace equipment, if needed, and attempt to enter into a new PPA with TVA or make some other arrangement to sell the power. When operations cease, the facilities would be decommissioned and dismantled, and the Project sites would be restored per Project decommissioning requirements. Following decommissioning of the solar facilities, the majority of the sites could be returned to agricultural use with little reduction in soil productivity or effect to prime farmland/farmland of statewide importance.

Approximately 23 percent of the Middle Tennessee TVA PSA is classified as prime farmland (USDA 2019b). An additional one percent would be classified as prime farmland if drained or protected from flooding. Most previously constructed TVA solar facilities have occupied prime farmland (Table 3.2-1). Because solar facilities are typically located on flat or gently sloping land that is more likely to be prime farmland than steeper areas, a large portion of the approximately 21,900 acres occupied by the proposed solar facilities is likely to be prime farmland. Prime farmland effects would be spread across 30 solar sites in the Middle Tennessee region, based on the assumption that each site is 100 MW. A portion of the 425 to 638 acres occupied by the storage facilities is also likely to be prime farmland. Minor loss of on-site prime farmland soils would not be significant when compared to the amount of prime farmland within the surrounding

region. However, the loss of farmland may result in moderate effects at a more local or county level. Most ground-mounted PV facilities have been constructed on previously cleared, frequently pasture, hayfield, or crop land, and most have required little grading to smooth or level the site. Although construction and operation of the PV facility usually eliminates agricultural production on the site, it typically does not adversely affect soil productivity or the ability to resume agricultural production once the PV facilities are removed. In some cases, the solar site is grazed by sheep or other livestock as a means of managing vegetation growth and is therefore maintained in agriculture. Effects on prime farmland soils would be reduced using appropriate BMPs to control erosion and limit sediment and soil from leaving the project sites. When project locations for solar and/or storage projects are determined, site-specific analyses would consider the potential effects on prime farmland and would be included in future NEPA reviews.

Future projects in the geographic area of analysis could result in prime farmland conversion. In addition to the 3,000 MW of solar facilities, TVA is proposing to add 10,000 MW of solar by 2035 to meet customer demands and system needs. This would also change undeveloped or agricultural sites, which could include prime farmland, to industrial uses. These future actions combined with the construction of the solar and storage facilities would likely result in prime farmland conversion. However, in view of the relatively large amounts of rural and undeveloped lands within the counties selected, cumulative impacts on prime farmland are anticipated to be moderate.

3.5.1.2.5.2. Transmission and Other Components

Geology and Paleontology

Under Alternative C transmission corridor installation, minor effects to geology could occur. Transmission structures associated with Alternative C are similar to those transmission lines constructed for Alternative B, although interconnection for solar facilities would be typically shorter. Due to the small sizes of the subsurface disturbances, only minor direct effects to potential subsurface geological resources are anticipated.

Should paleontological resources be exposed during site construction (i.e., grading and foundation placement) or operation activities, a paleontological expert would be consulted to determine the nature of the paleontological resources, recover these resources, analyze the potential for additional effects, and develop and implement a recovery plan/mitigation strategy.

Soils

Under Alternative C, the transmission line upgrade activities would also result in minor effects to soils. Minimal ground disturbance is expected in these areas, but if the ground is disturbed, the access road area would be revegetated using native, low-growing plant species after required TL upgrade work is completed to minimize the potential for increased soil erosion and runoff. Since the exact project locations for solar and/or storage projects and associated TL upgrade activities are not known at this time, according to the analysis described in Section 2.1.5.2.4, an average of 17.73 acres could be impacted due to transmission and electrical system components per solar site. Based on the assumption of thirty 100 MW solar sites, Alternative C would result in approximately 532 acres of impacts to soils for construction of transmission components. However, effects to soils associated with TL upgrades would be temporary and mitigated through BMPs identified in Section 2.3. No cumulative impacts to soils are anticipated.

Prime Farmland

Under Alternative C, the transmission line upgrade activities could result in minor effects to prime farmland. Since the exact project locations for solar and/or storage projects and

associated TL upgrade activities are not known at this time, TVA compiled a list of typical effects from construction activities related to transmission projects in the 2019 IRP EIS. A total of 298 projects were included in the review. The review determined that TL construction did not result in prime farmland conversion while 64 percent of new substation and switching station construction resulted in prime farmland conversion. TL upgrade activities resulted in no prime farmland conversions and an average of 6.9 acres (ranging from zero to 29.1 acres) of prime farmland were used for new substation and switching stations. Based on an assumption of thirty 100 MW solar sites that have new substation and switching station construction, approximately 19 sites would result in prime farmland conversion and a total of 131 acres of prime farmland conversions would occur. No cumulative impacts to prime farmland are anticipated.

3.5.2. Floodplains

3.5.2.1. Regulatory Framework for Floodplains

TVA adheres to the requirements of EO 11988, Floodplain Management. The objective of EO 11988 is "…to avoid to the extent possible the long- and short-term adverse effects associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (EO 11988, Floodplain Management). The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances (U.S. Water Resources Council 1978). The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative.

For "Critical Actions," the minimum floodplain of concern is the 500-year floodplain. The U.S. Water Resources Council defines "critical actions" as "any activity for which even a slight chance of flooding would be too great" (U.S. Water Resources Council 1978). Critical actions can include facilities producing hazardous materials (such as liquefied natural gas terminals); facilities whose occupants may be unable to evacuate quickly (such as schools and nursing homes); and facilities containing or providing essential and irreplaceable records, utilities, and/or emergency services (such as large power-generating facilities, data centers, museums, hospitals, or emergency operations centers) (TVA 2019b).

EO 13690, *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input*, was reinstated in May 2021. However, implementation of EO 13690 is still in development at the national level. TVA is working with other federal agencies to develop consistent implementing plans for these EO requirements. When those implementing plans are finalized, TVA would incorporate floodplain analysis with respect to EO 13690, in addition to EO 11988.

3.5.2.2. Affected Environment

A floodplain is the relatively level land area along a stream or river that is subject to periodic flooding. The area subject to a 1 percent chance of flooding in any given year is normally called the 100-year floodplain or base floodplain. The area subject to a 0.2 percent chance of flooding in any given year is normally called the 500-year floodplain.

3.5.2.2.1. CUF Reservation

CUF is located along the left descending bank of the Cumberland River between River Mile (RM) 102.5 and RM 104.0, adjacent to Wells Creek from its mouth to about creek mile 2.6. Scott Branch is a tributary of Wells Creek at about Wells Creek mile 1.5.

An updated Federal Emergency Management Agency (FEMA) flood insurance study (FIS) for Stewart County, Tennessee, became effective January 15, 2021. Based on Flood Profile 44P of

the 2021 Stewart County FIS, the 100-year flood elevation at Cumberland River Mile (CRM) 102.8 at the confluence of Wells Creek would be 380.6 feet, referenced to NAVD 1988. The drainage area of Wells Creek is approximately 57 square miles (USGS 2017). Because the drainage area of the Cumberland River at Wells Creek is far greater than the drainage area of Wells Creek or Scott Branch, the 100-year flood elevations on the Cumberland River would govern water surface elevations in a 100-year flood. The 100- and 500-year flood elevations on Wells Creek and Scott Branch in the vicinity of CUF would therefore be 380.6 and 385.3 feet, respectively. Portions of the northern part of the demolition boundary (Figure 2.1-1 and Figure 3.5-10) are within the 100-year floodplain of the Cumberland River.

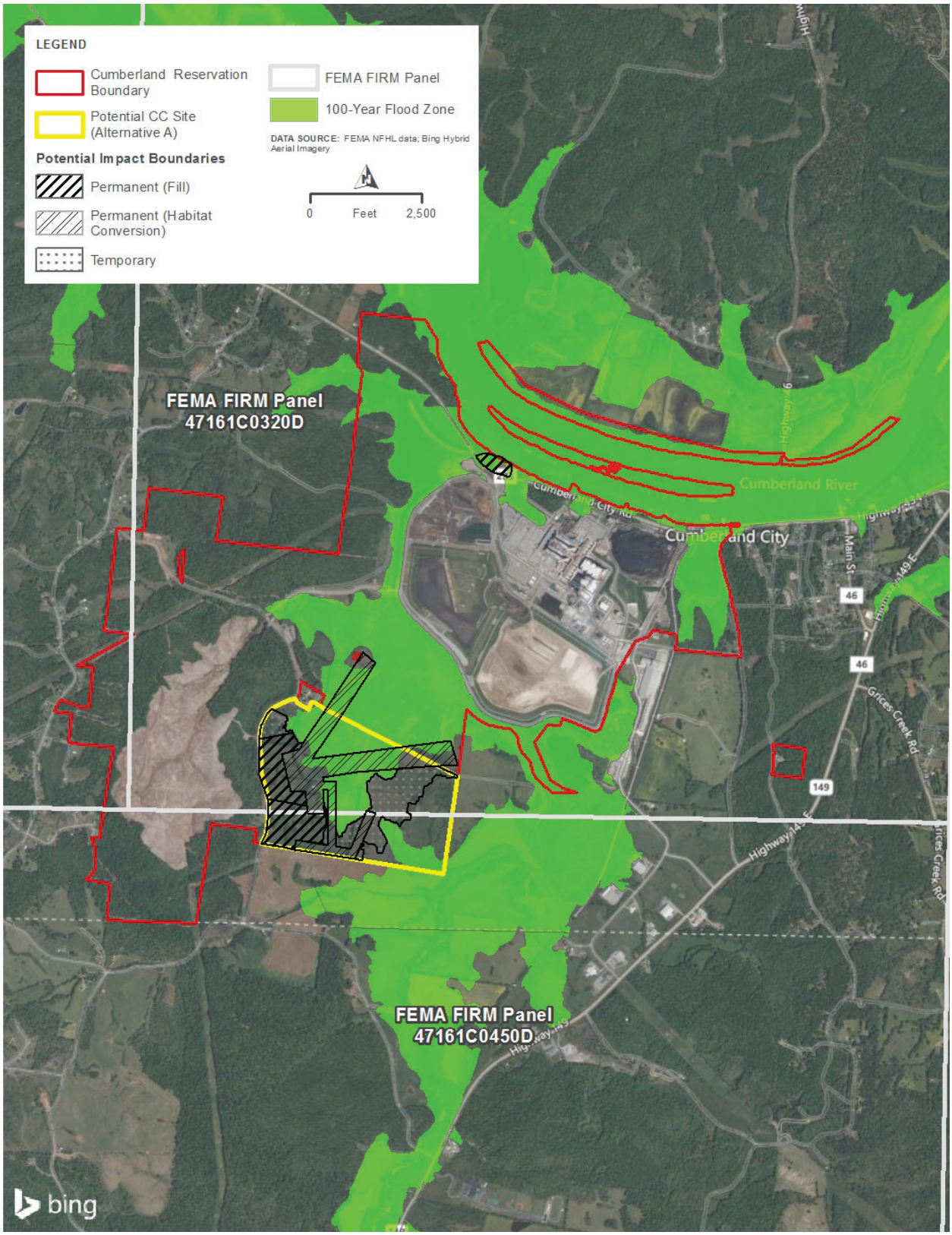

Figure 3.5-10. Flood zones in the vicinity of the CUF Reservation

3.5.2.2.2. Alternative A

3.5.2.2.2.1. Proposed CC Plant Site

Based on GIS mapping, about one-third of the original CC plant site boundaries (Option A2) would be located within the 100-year floodplain of Wells Creek (Figure 3.5-10). Transmission corridors associated with Alternative A would be located within the CUF Reservation and would cross floodplains associated with Wells Creek and the Cumberland River.

Within the Potential Impact Boundaries, none of the permanent fill locations are proposed within the floodplain. However, 48 acres (52%) of the transmission lines would be constructed within the 100-year flood zone (the permanent habitat conversion identified in Figure 3.5-10).

3.5.2.2.2.2. Natural Gas Pipeline Corridor

Based on desktop mapping, the proposed gas pipeline corridor would cross the 100-year floodplains of several streams (Figure 3.5-11). Moving from west to southeast, those streams and their floodplain areas within the pipeline corridor are:

- 25.8 acres associated with Wells Creek
- 5.1 acres associated with Guices Creek
- 16.2 acres associated with Yellow Creek
- 1.6 acres associated with Little Bartons Creek
- 3.5 acres associated with Dry Hollow Branch
- 2.8 acres associated with Furnace Creek
- 2.5 acres associated with Bartons Creek
- 44.1 acres associated with Jones Creek

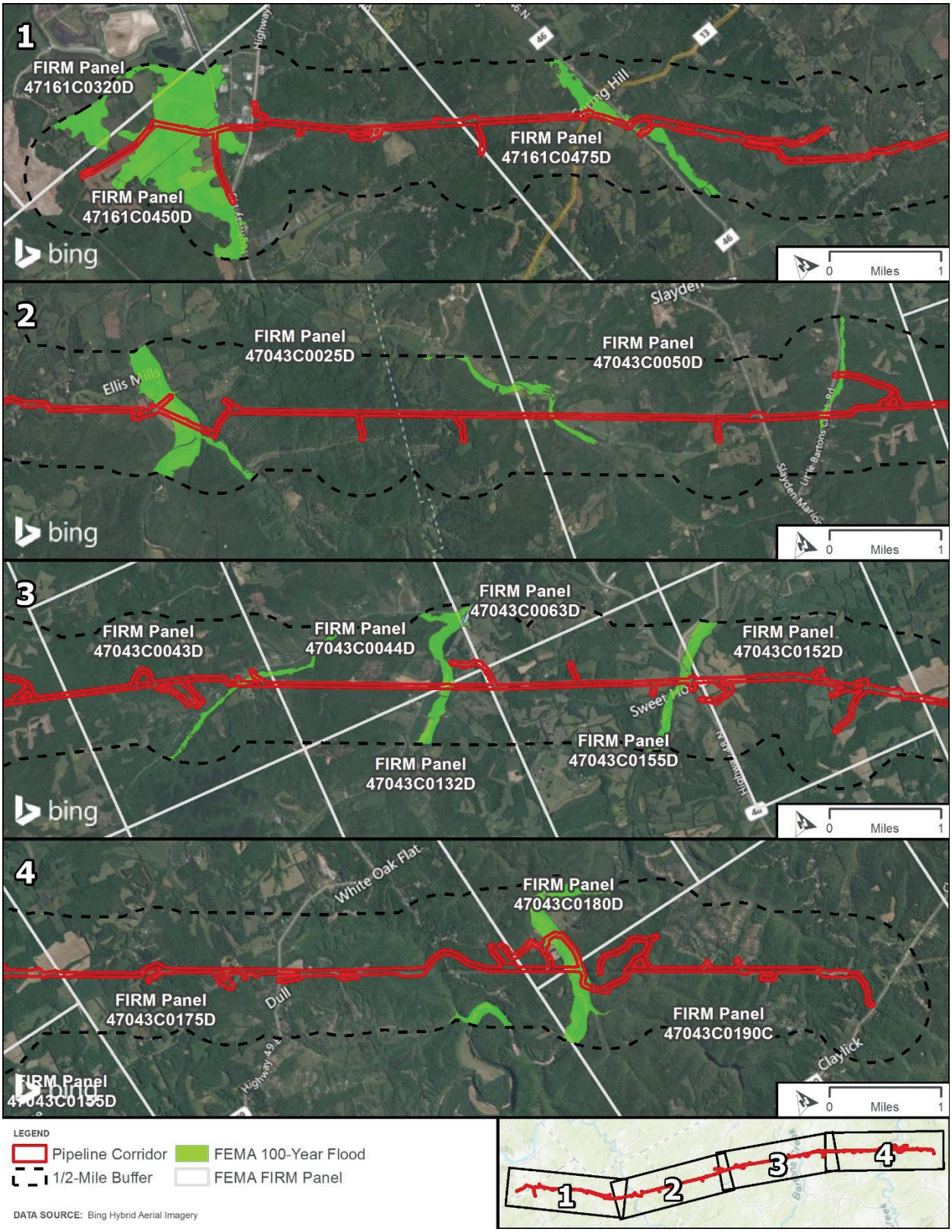

Figure 3.5-11. Flood zones within the proposed natural gas pipeline corridor

3.5.2.2.3. Alternative B

3.5.2.2.3.1. Johnsonville Reservation

The JCT is located on the eastern bank of the Tennessee River, at about Tennessee River Mile 99. At this location, the 100-year flood elevation would be 375.0 feet. Although a portion of the reservation is within the 100-year floodplain (Figure 3.5-12), the CT plant site is outside the 100-year floodplain.

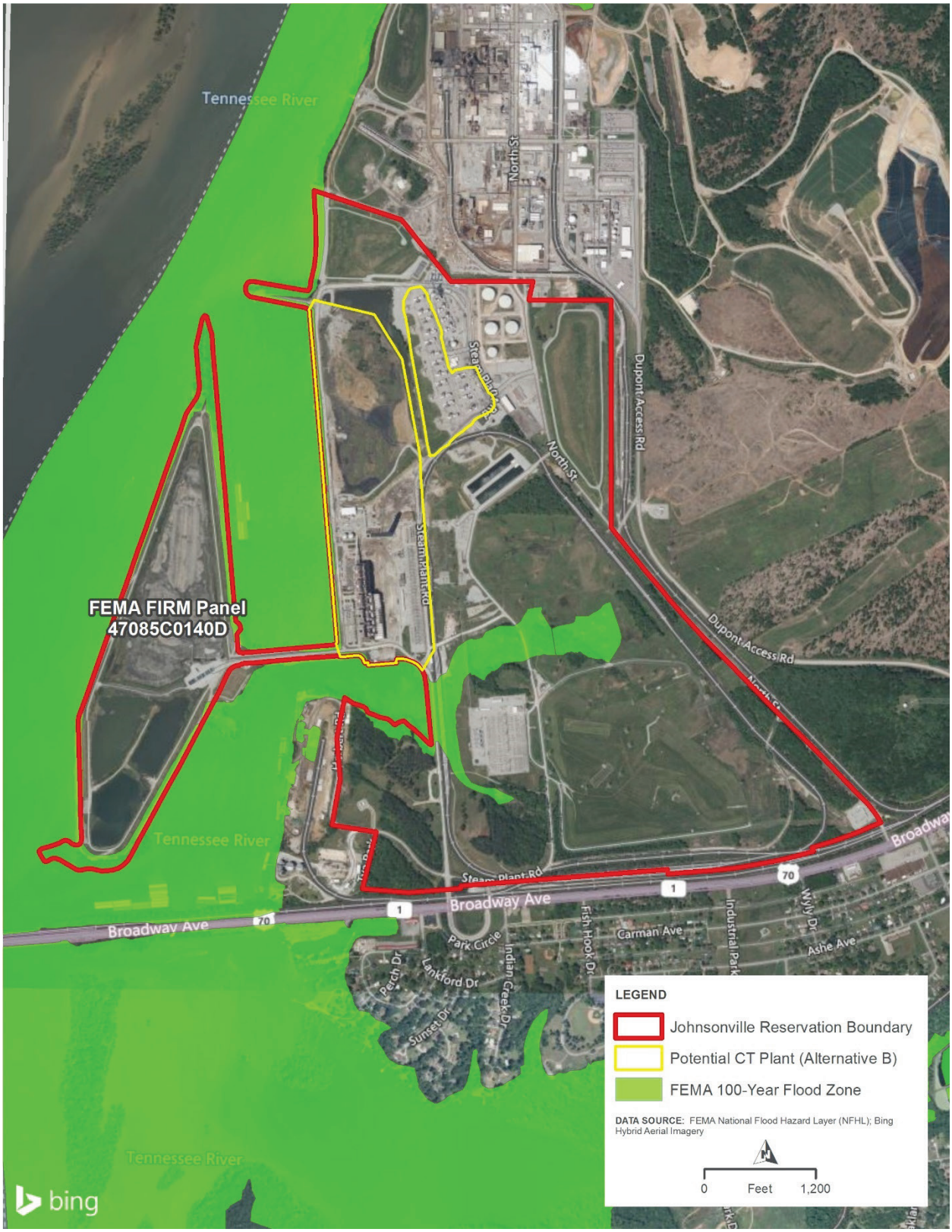

Figure 3.5-12. Flood zones in the vicinity of the JCT Reservation

3.5.2.2.3.2. Gleason Reservation

Gleason is located approximately 0.3 miles south of the Middle Fork Obion River. Approximately 12.3 acres of the northern portion of the proposed CT plant site are in the Middle Fork Obion River 100-year floodplain (Figure 3.5-13).

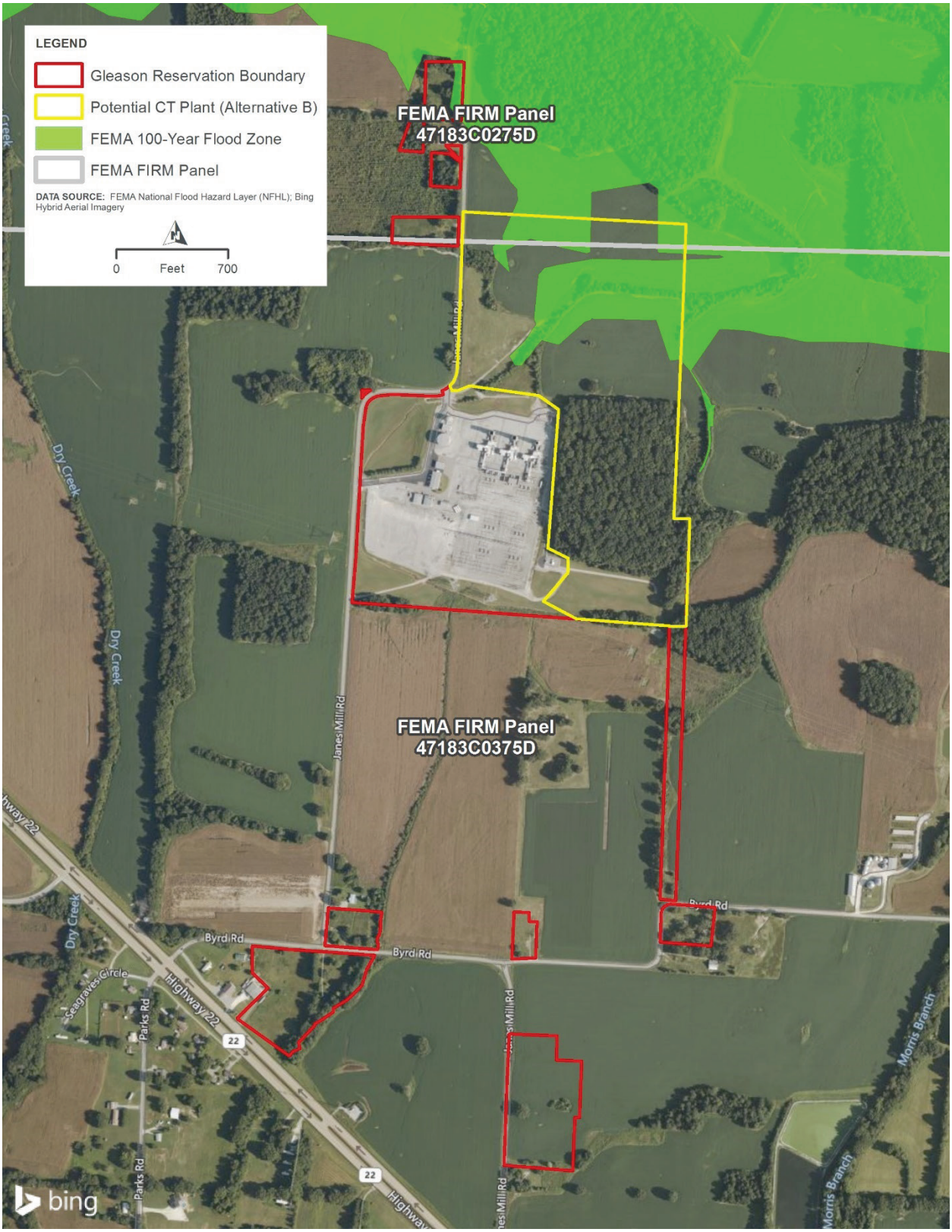

Figure 3.5-13. Flood zones in the vicinity of the Gleason Reservation

3.5.2.2.3.3. Transmission Corridors

Under Alternative B, TVA would construct an approximately 40-mile, 500-kV TL from Weakley to a new station on the Marshall-Cumberland 500 kV TL. The route could potentially cross floodplains associated with the following streams and their tributaries: Mud Creek, Cypress Creek, Thompson Creek, and Cane Creek Branch, in Weakley County, Tennessee; as well as Old Town Creek, Walnut Fork Creek, Spring Hill Creek, Bird Creek, North Fork Obion River, Holly Fork Creek, and South Fork Eagle Creek, in Henry County, Tennessee.

3.5.2.2.4. Alternative C

3.5.2.2.4.1. Middle Tennessee TVA Power Service Area

TVA anticipates that a portion of the solar facilities proposed under Alternative C would be located in Middle Tennessee in order to offset transmission system upgrades that may be required following the retirement of CUF as described in further detail in Section 2.1.5. The Tennessee and Cumberland rivers are the two main streams in Middle Tennessee. Major tributaries of the Tennessee River in Middle Tennessee include the Buffalo, Duck, and Elk rivers. Major tributaries of the Cumberland River in Middle Tennessee include the Caney Fork, Collins, Harpeth, Obey, Red, and Stones rivers.

3.5.2.3. Environmental Consequences

3.5.2.3.1. The No Action Alternative

Under the No Action Alternative, TVA would continue current plant operations. TVA would implement all of the planned actions related to the current and future management and storage of CCRs, which have either been reviewed or will be reviewed in subsequent NEPA analysis. There would be no new direct or indirect effects to floodplains because there would be no physical changes to the current conditions. Current effects would continue to be minimized by using BMPs and erosion control measures.

3.5.2.3.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Most of the CUF Reservation where the existing plant would be decommissioned, decontaminated, and deconstructed is located outside of the 100-year floodplain. Portions of CUF in the northern portions of the site, including the barge facilities, are located within the Cumberland River floodplain. Structures and facilities, such as laydown areas, haul roads, and staging areas, would be constructed and sited, where practicable, outside of the 100-year floodplain. If decommissioning and deconstruction activities or structures must be located in floodplains, these activities would be considered temporary uses of the 100-year flood zone and, therefore, would have no permanent effects on floodplains or floodplain resources. Also, standard BMPs would be employed in order to minimize adverse effects during construction activities. To further minimize adverse effects, decommissioning and deconstruction debris would be disposed of outside 100-year floodplains. Additionally, any flood-damageable equipment or materials located within the 100-year floodplain would be relocated outside the floodplain in advance of a predicted flood. No cumulative effects to floodplains would occur, as planned CCR management activities on the CUF Reservation would avoid and minimize effects to floodplains and adhere to federal and local floodplain management guidelines.

3.5.2.3.3. Alternative A

3.5.2.3.3.1. Construction and Operation of CC Plant at CUF

The original proposed CC Plant construction site (Option A2) included 102.8 acres of 100-year floodplains; however, the CC Plant footprint and plant construction were then modified to avoid the 100-year floodplain and be located well above the approximate 500-year flood elevation

385.3. Site runoff and erosion are addressed in Section 3.2 Water Resources. The revised potential impact boundaries associated with Alternative A would temporarily impact 48 acres and permanently impact five acres of 100-year floodplain. Five of those acres are permanent fill associated with the barge unloading area, and 48 of those acres are temporary land disturbances associated with TL upgrades (Figure 3.5-10). Haul roads and access roads could potentially be located within 100-year floodplains. Consistent with EO 11988, roads are considered to be repetitive actions in the 100-year floodplain that should result in minor impacts. To minimize adverse impacts, roads would be constructed such that upstream flood elevations would not be increased by more than 1.0 foot. Also, standard BMPs will be employed in order to minimize adverse effects during construction activities. Additionally, any flood-damageable equipment or materials located within the 100-year floodplain would be relocated outside the floodplain during a flood. No cumulative effects to floodplains would occur.

3.5.2.3.3.2. Construction and Operation of Natural Gas Pipeline

As shown in Figure 3.5-11, the pipeline corridor would cross 100-year floodplains in several places, with potential to affect up to 102 acres within the 100-year floodplain. Consistent with EO 11988, gas pipelines are considered to be repetitive actions in the 100-year floodplain that should result in minor effects (TVA 1981). The pipeline would be installed through trenching or directional drilling. To minimize adverse effects, any excess fill resulting from this would be disposed of outside 100-year floodplains. Short-term effects may occur as the construction area is restored and re-vegetated. The project would have no impact on floodplains or their natural and beneficial values because the pipeline would be buried. During construction, if a heavy rain event were predicted, special precautions would be taken within the floodplain to minimize effects. Such precautions may include, but are not limited to, removing large construction equipment from the floodplain, temporary stabilization measures where soils are exposed, and maintaining any soil stockpiles outside the boundaries of the floodplain.

While past/present and RFFAs would occur in proximity to the proposed pipeline, no cumulative effects to floodplains would occur.

3.5.2.3.3.3. Transmission and Other Components

A portion of the area in which the new, short TLs and other transmission system components would be built is within the 100-year floodplain (Figure 3.5-10). Consistent with EO 11988, TLs are considered to be repetitive actions in the 100-year floodplain that should result in minor effects (TVA 1981). The conducting wires of the transmission line would be located well above the 100-year flood elevation. The support structures for the transmission line would not be expected to result in any increase in flood hazard from increased flood elevations or from changes in flow-carrying capacity of the streams being crossed. Construction in the floodplain would be consistent with EO 11988 provided the TVA subclass review criteria for transmission line location in floodplains are followed.

3.5.2.3.3.4. Summary of Alternative A

In sum, the revised potential impact boundaries associated with Alternative A would temporarily impact 48 acres and permanently impact five acres of 100-year floodplain. The pipeline corridor would cross 100-year floodplains in several places, with potential to affect up to 102 acres within the 100-year floodplain. Based on mitigation measures noted above and listed in Section 2.3.1, Alternative A would have no significant impact on floodplains and their natural and beneficial values.

3.5.2.3.3.5. Environmental Justice Considerations

Effects to floodplains as a result of construction of the natural gas pipeline lateral may have temporary, minor adverse effects on human populations within the corridor where the pipeline would be constructed. While certain actions would be taken to reduce the risk of flood loss and minimize the effect of floods on human safety, health, and welfare, such effects would occur where human populations and floodplains co-exist. These effects may be amplified on EJ populations since approximately 57 percent of the floodplains are in EJ areas, and these low-income and minority populations may be more vulnerable to temporary effects to floodplains that cause flood loss or effects to human safety, health, and welfare.

3.5.2.3.4. Alternative B

3.5.2.3.4.1. Construction and Operation of CT Plant at JCT Reservation

Consistent with EO 11988, the proposed CT plant site at JCT is located outside of the 100-year floodplain (Figure 3.5-12). No cumulative effects to floodplains would occur.

3.5.2.3.4.2. Construction and Operation of CT Plant at Gleason Reservation

A portion of the potential CT plant site is within the 100-year floodplain (Figure 3.5-13). Structures and facilities, such as laydown areas, haul roads, and staging areas, would be constructed, and portions of them could be located within 100-year floodplains. These activities would be temporary uses of the 100-year floodplain and have no permanent effects on floodplains or floodplain resources. Standard BMPs would be employed in order to minimize adverse effects during construction activities. Additionally, any flood-damageable equipment or materials located within the 100-year floodplain would be relocated outside the floodplain during a flood. No cumulative effects to floodplains would occur.

3.5.2.3.4.3. Transmission and Other Components

While the final transmission route has not been determined, portions of the TL would likely cross 100-year floodplains. Consistent with EO 11988, TLs and related support structures are considered to be repetitive actions in the 100-year floodplain that should result in minor effects. The conducting wires of the transmission line would be located well above the 100-year flood elevation. The support structures for the TLs would not be expected to result in any increase in flood hazard from increased flood elevations or from changes in flow-carrying capacity of the streams being crossed. Construction in the floodplain would be consistent with EO 11988 provided the TVA subclass review criteria for transmission lines located in floodplains are followed.

For any access roads proposed within 100-year floodplains but not floodways, the roads would be constructed such that flood elevations would not increase more than 1.0 foot. For any roads proposed within 100-year floodways, and to prevent an obstruction in the floodway, (1) any fill, gravel or other modifications in the floodway that extend above the pre-construction road grade would be removed after completion of the project; (2) this excess material would be spoiled outside of the published floodway; and (3) the area would be returned to its pre-construction condition.

The new switchyard would be located outside of 100-year floodplains, which would be consistent with EO 11988.

Based on mitigation measures noted above and listed in Section 2.3.1, Alternative B would have no significant impact on floodplains and their natural and beneficial values.

3.5.2.3.5. Alternative C

3.5.2.3.5.1. Construction and Operation of Solar and Storage Facilities

Under the Proposed Action Alternative C, CUF would be retired and demolished, and a combination of solar and storage facilities would replace the first CUF unit. As specific sites have not yet been determined for evaluation under this alternative, typical effects of solar projects have been listed in Table 3.2-1. The solar and storage facilities would be sited in a manner to avoid floodplains to the extent feasible. If avoidance is not feasible, the flood-damageable components of the solar panels, as well as other flood-damageable structures and facilities sited in floodplains, would be located at least one foot above the 100-year flood elevation at that location and would otherwise be consistent with local floodplain regulations. Based on a review of typical effects of solar facility construction activities, approximately 0.02 acre of floodplains are impacted per MW of solar facilities, with a range of 0 to 1.8 acres per MW (Table 3.2-1). The addition of 3,000 MW of solar under Alternative C could therefore result in an average of 60 acres of floodplain effects. Floodplain effects would be spread across approximately 30thirty sites, assuming each site is 100 MW.

Floodplain effects are not anticipated for storage facilities as they are typically sited to avoid floodplains. For any roads proposed within 100-year floodplains but not floodways, the roads would be constructed such that flood elevations would not increase more than 1.0 foot. For any roads proposed within 100-year floodways, and to prevent an obstruction in the floodway, (1) any fill, gravel, or other modifications in the floodway that extend above the pre-construction road grade would be removed after completion of the project; (2) this excess material would be spoiled outside of the published floodway; and (3) the area would be returned to its pre-construction condition. If other structures are proposed within 100-year floodplains, they would need to be analyzed in a subsequent environmental review.

Cumulative effects to floodplains may occur under Alternative C with the addition of 10,000 MW of solar identified in the 2019 IRP throughout the TVA PSA. Based on the average of 0.02 linear feet of impact per MW, this would result in 200 acres of additional floodplain effects within the TVA PSA. Cumulative effects to floodplains would be minimized through proper siting of solar facilities, and the use of BMPs, and adherence to local floodplain regulations.

3.5.2.3.5.2. Transmission and Other Components

The final transmission route has not been determined; however, the TL would likely cross 100-year floodplains. Consistent with EO 11988, transmission lines and related support structures are considered to be repetitive actions in the 100-year floodplain that should result in minor effects. The conducting wires of the transmission line would be located well above the 100-year flood elevation. The support structures for the transmission line would not be expected to result in any increase in flood hazard from increased flood elevations or from changes in flow-carrying capacity of the streams being crossed. Construction in the floodplain would be consistent with EO 11988 provided the TVA subclass review criteria for transmission line location in floodplains are followed.

For any access roads proposed within 100-year floodplains but not floodways, the roads would be constructed such that flood elevations would not increase by more than 1.0 foot. For any roads proposed within 100-year floodways, and to prevent an obstruction in the floodway, (1) any fill, gravel, or other modifications in the floodway that extend above the pre-construction road grade would be removed after completion of the project; (2) this excess material would be spoiled outside of the published floodway; and (3) the area would be returned to its pre-construction condition.

Any new switchyards and substations would, to the extent practicable, be located outside of 100-year floodplains. For switchyards and substations proposed within 100-year floodplains, TVA would evaluate the site(s) under the Floodplain No Practicable Alternative analysis and either alter plans to avoid the floodplain or determine that there would be no practicable alternative to locating within the floodplain. If TVA determines that there would be no practicable alternative to locating the facility within the 100-year floodplain, adverse effects would be minimized. To minimize adverse effects, the switchyard or substation would be located a minimum of one foot above the 100-year flood elevation at that location and would be consistent with local floodplain regulations.

Cumulative effects to floodplains may occur under Alternative C with the addition of 10,000 MW of solar identified in the 2019 IRP throughout the TVA PSA. Transmission lines associated with this expansion would likely cross 100-year floodplains. Cumulative effects to floodplains would be minimized through proper siting of transmission lines and adhering to the TVA subclass review criteria and local floodplain regulations.

Based on mitigation measures noted above and listed in Section 2.3.1, Alternative C would have no significant impact on floodplains and their natural and beneficial values.

3.6. Water Resources

3.6.1. Groundwater

The Safe Drinking Water Act of 1974 established the sole source aquifer protection program, which regulates certain activities in areas where the aquifer (water-bearing geologic formations) provides at least half of the drinking water consumed in the overlying area. This act also established both the Wellhead Protection Program, a pollution prevention and management program used to protect underground sources of drinking water, and the Underground Injection Control Program to protect underground sources of drinking water from contamination by fluids injected into wells. Several other environmental laws contain provisions aimed at protecting groundwater, including the RCRA; the Comprehensive Environmental Response, Compensation, and Liability Act; and the Federal Insecticide, Fungicide, and Rodenticide Act. On April 17, 2015, the USEPA published the CCR Rule in the *Federal Register* to provide a comprehensive set of requirements for the safe disposal of CCRs from coal-fired power plants. The CCR Rule addresses the risks of coal ash contaminants migrating into groundwater. The CCR Rule was revised on August 29, 2018 (USEPA 2018).

3.6.1.1. Affected Environment

3.6.1.1.1. CUF Reservation

CUF is located just to the north of the center of the Wells Creek Structure. The center of the structure to the south of the plant is mostly overlain by the Wells Creek Embayment. This embayment is low lying and drains into the Cumberland River to the north. Wells Creek drains from the south to the north and borders the southern and western portion of CUF. The potentiometric groundwater surface at the facility appears to be oriented to the south and west towards Wells Creek (TVA 2016b). Most of the soils are fill material around the plant or alluvial soils deposited by Wells Creek and the Cumberland River. The alluvial soils range from 5 to 43 feet in thickness (Law Engineering 1992). Based on the 1992 report, groundwater is present within the alluvial material. The Alluvial aquifer consists of water-bearing sand and gravel deposits associated with streams and floodplains.

Bedrock of carbonate formations of the Highland Rim is generally slightly alkaline and high in dissolved solids and hardness. The quality of groundwater from shallow bedrock aquifers is

generally soft to moderately hard but may contain elevated concentrations of iron. Most groundwater from the alluvium along the Cumberland River is generally harder and contains more iron than groundwater derived from the bedrock aquifers. TVA, as part of adhering to the Tennessee Division of Solid Waste Management Regulations, has monitored existing onsite wells around the CUF wastewater treatment ponds. Since 2012, monitoring well concentrations have not exceeded groundwater protection standards.

According to USGS, the CUF Reservation overlies the Mississippian carbonate aquifer system. Groundwater within this limestone and dolomite aquifer is confined to partly confined near land surface and may be confined at depth. Water within the aquifer occurs in solution-enlarged openings (fractures, bedding plains, small to large caves). The Ste. Genevieve, Monteagle, St. Louis, and Warsaw Limestones and the Fort Payne Formation are the principal water bearing formations of the Mississippian carbonate aquifer. Approximately 16.63 million gallons per day of water is withdrawn from the Mississippian aquifer for public use. Water obtained from the aquifer contains high levels of calcium carbonate, iron, and sulfate (Burchett and Hollyday 1974; Brahana and Bradley 1986).

Groundwater in the area can be affected by agricultural pumping and local surface water bodies but either flows north toward the Cumberland River or south and west to Wells Creek. Wells Creek ultimately discharges to the Cumberland River. Groundwater levels near the CUF Reservation are largely controlled by the Cumberland River where the surrounding groundwater discharges.

A study conducted in 1990 found that the water table beneath the CUF Reservation ranges from 0 to 40 feet deep with a soil thickness of 0 to 33 feet. The center of the plant overlays karst terrain with a shallow depth to water. Ten water supply wells are located within a one-mile radius of the CUF Reservation. Additionally, one well is located within the CUF Reservation. TVA conducts regular groundwater sampling of wells located on the reservation. The most recent event was conducted in July 2021 and TDEC MCL exceedances of arsenic, cobalt, lithium, molybdenum, nickel, radium 226 + radium 228, sulfate, total dissolved solids (TDS), and zinc were detected in at least one well.

3.6.1.1.2. Alternative A

3.6.1.1.2.1. Proposed CC Plant

According to USGS, the proposed CC plant site and transmission structures overlies the Mississippian carbonate aquifer system, as described in Section 3.6.1.1.3.3.

3.6.1.1.2.2. Natural Gas Pipeline Corridor

As stated in TGP's Resource Report 2 (TGP 2022b):

> [the pipeline corridor is] located within the Mississippian Aquifer of the Western Highland Rim region of Tennessee […]. The Mississippian Aquifer is a primary aquifer that sporadically occurs across Northeastern America in a "v" shape pattern, spanning from northern Pennsylvania down to central Alabama through Ohio, West Virginia, Virginia, Kentucky, and Tennessee, then extending back up into northern Iowa through Indiana, Illinois, and Missouri. This confined aquifer system primarily is composed of limestone and dolomite and is underlined by the Chattanooga Shale formation. The primary water-bearing formations of the Mississippian Aquifer are the Ste. Genevieve Limestone, St. Louis Limestone, Warsaw Limestone, and Fort Payne Formations.

> More specifically, the [pipeline corridor] falls within the Western Highland Rim Aquifer, a regional aquifer within the Mississippian Aquifer. This aquifer system is primarily composed of Mississippian carbonate and large bedded limestone formations with portions that have interbedded evaporites, chert nodules, layers, and stringers throughout its thickness. The rocks found within this formation have been weathered down to clay regolith and chert gravel rocks that have low intragranular porosity and permeability (USGS 1986).
>
> Groundwater within the Western Highland Rim Aquifer primarily occurs within the second openings including solution openings, joints, and faults of the Warsaw limestone formation. Water found within this formation is considered good for drinking water and industrial use. The Highland Rim Aquifer supplies a majority of the domestic, rural, and public water supplies for Dickson, Houston, and Stewart counties, Tennessee (USDOI 1984). Wells within this aquifer yield between 1 to more than 400 gallons per minute (gpm) and contain less than 100 to greater than 10,000 mg/L of dissolved solids in areas with dynamic flow systems. Groundwater flow follows the same pattern as the surface drainage by flowing away from upland regions and towards the lower water-level altitudes of the valley at an average of 0.26 cubic feet per second (cfs) per square mile. Groundwater is recharged from precipitation, resulting in large fluctuations in the groundwater level, often causing shallow wells to dry out during the summer months.

There are four documented sites of contamination within the Western Highland Rim Aquifer. One of them, in Wayne County, Tennessee, has been remediated (TGP 2022b) and is unlikely to affect groundwater in the pipeline area. The remaining three documentations of contamination to the aquifer involved the illegal dumping of waste in into sinkholes (TGP 2022b). This dumping resulted in elevated levels of sulfuric acid and alums. Additionally, the dumping site located in Montgomery County, located approximately 15 miles from the pipeline corridor, tested positive for elevated levels of trace constituents of petroleum products. The remaining two sites were not identified; however, it was noted that the contamination at these two sites was limited to a small portion of the aquifer and does not appear to have threatened the aquifer system (TGP 2022b).

The Western Highland Rim Aquifer is used as a source of drinking water for 35 municipal water systems in Tennessee and supplies a majority of the drinking water for rural domestic and non-community use throughout the region (TGP 2022b). The average agricultural, public, and industrial well yields 5 to 50 gallons of water per minute but can locally exceed yield rates of 400 gallons of water per minute (TGP 2022b). Carbonate rocks prone to karst development are present beneath the pipeline corridor and are prevalent in the greater Highland Rim region of Tennessee. TGP performed an assessment of the karst development in the pipeline area, as summarized in Section 3.5.1.1.2.2. Based on the results of that assessment, TGP will address potential impacts to groundwater resources in areas where karst deposits are present and the efforts that will be taken to minimize or eliminate these impacts in a Karst Monitoring and Mitigation Plan (TGP 2022b).

The Sole-Source Aquifer designations were defined by the USEPA, pursuant to Section 1424(e) of the Safe Drinking Water Act (“SDWA”), as an aquifer that provides a sole or principal source (greater than 50 percent) of drinking water for an area, where contamination of the aquifer could create a significant hazard to public health, and where there are no alternative water sources that could reasonably be anticipated to replace the water supplied by the aquifer (USEPA

2021a). According to the USEPA Interactive Map of Sole-Source Aquifers (USEPA 2021b), there are no USEPA-designated sole-source aquifers in the vicinity of the pipeline.

Per TGP's Resource Report 2 (TGP 2022b):

> Under a 1986 amendment to the SDWA, each state is required to develop and implement a wellhead protection program in order to identify the land and recharge areas contributing to public supply wells and prevent the contamination of drinking water supplies. The SDWA was later updated in 1996 with an amendment requiring the development of a broader-based Source Water Assessment Program, which includes the assessment of potential contamination to both groundwater and surface water through a watershed approach. States assess and delineate groundwater protection areas under a combination of these mandates.
>
> TDEC Division of Water Resources has responsibility for protecting the water resources of the State of Tennessee, including surface water, groundwater, and wellhead protection. No state or local wellhead protection areas were identified within one mile of the pipeline corridor based on data from the National Ground-Water Monitoring Network. TDEC classifies the locations of wellhead and water protection areas as confidential. TDEC confirmed the presence of one wellhead protection area and five water protection areas within a six-mile radius of the [pipeline] area but did not provide the specific location of these areas. TDEC provided a list of the sources of water that impact the wellhead and water protection areas. Based on this list, Yellow Creek is the only source of water listed by the wellhead and water protection areas that may potentially be impacted by the [pipeline]. Yellow Creek is one of five sources of water for the Vanleer Water Department that serves a population of 2,995 residents. [Because the pipeline would be constructed by horizontal directional drilling under Yellow Creek], TGP anticipates that no impacts to wellhead and water protection areas would occur.

There are 62 private water supply wells and springs within 1,000 feet of the project area, with eleven of those wells located within 150 ft of the project area (Table 2.2-2 in TGP 2022b).

3.6.1.1.3. Alternative B

3.6.1.1.3.1. Johnsonville Reservation

According to USGS, the JCT Reservation overlies the Cretaceous sand aquifer system which consists of the McNairy and Coffee Sands and the Tuscaloosa Formation. Groundwater within this sand aquifer is unconfined in the outcrop area in the vicinity of JCT. Approximately 7 million gallons per day of water are withdrawn from the Cretaceous sand aquifer for public use. Water obtained from the aquifer contains high levels of iron in some areas (Brahana and Bradley 1986). Groundwater in the area can be affected by agricultural pumping and local surface water bodies, but it is expected to flow west to the Tennessee River.

3.6.1.1.3.2. Gleason Reservation

According to USGS, the Gleason Reservation overlies the Tertiary sand aquifer system. The Tertiary sand aquifer consists of interbedded sand and clay with a thickness range of 100 to 2,000 feet and includes the Jackson, Claiborne, and Wilcox aquifer formations. Groundwater within this aquifer is confined near the Mississippi River and unconfined further east. Approximately 188 million gallons per day of water are withdrawn from the Tertiary sand aquifer for public use (Brahana and Bradley 1986).

General groundwater quality of the Tertiary aquifer is good to excellent and is classified as an underground drinking water source as defined by the EPA. Groundwater recharge for the aquifer is through rainfall on the outcrops of the aquifer. Groundwater located in the alluvium and terrace deposits overlain by thick loess is generally hard and has high iron and dissolved solid concentrations, while groundwater in the terrace deposit overlain by gravel and thin loess is soft and has low iron and dissolved solid concentrations (Brahana and Bradley 1986). Groundwater in the area can be affected by agricultural pumping and local surface water bodies but is expected to flow north to the Middle Fork Obion River.

3.6.1.1.3.3. Transmission Corridor

According to USGS, the Alternative B transmission corridor overlies the Mississippian carbonate aquifer system, the Cretaceous sand aquifer system, or the Tertiary sand aquifer system, depending on location. Groundwater within the Mississippian limestone and dolomite aquifer is the same as described for the CUF Reservation in Section 3.6.1.1.1.

The Cretaceous sand aquifer system consists of the McNairy and Coffee Sands and the Eutaw and Tuscaloosa Formations. Groundwater within this sand aquifer is unconfined in the outcrop area in the vicinity of Johnsonville. Approximately 7 million gallons per day of water are withdrawn from the Cretaceous sand aquifer for public use (Brahana and Bradley 1986).

General groundwater quality of the Cretaceous aquifer is good within the outcrops and upper parts of the aquifer with more mineralized water in the lower confined part of the aquifer to the west and southwest. Water quality within the McNairy sand unit is typically a bicarbonate water type with high iron concentrations and low dissolved solids. Water quality within the Coffee sand unit is typically a calcium bicarbonate water type with high iron and low dissolved solids with higher sulfate and lower chloride than the Eutaw formation. Water quality within the Eutaw formation is typically a sodium bicarbonate water type with low dissolved solids. Water quality within the Tuscaloosa formation is typically a sodium or calcium bicarbonate water type with low dissolved solids (Brahana and Bradley 1986).

The Tertiary sand aquifer conditions are the same as described for the Gleason Reservation in Section 3.6.1.1.3.2. Groundwater in the area can be affected by agricultural pumping and local surface water bodies.

3.6.1.1.4. Alternative C

3.6.1.1.4.1. Middle Tennessee TVA Power Service Area

The project area overlays the Alluvial aquifer, Tertiary sand aquifer, Cretaceous sand aquifer, the Pennsylvanian sandstone aquifer, Mississippian carbonate aquifer system, the Ordovician carbonate aquifer, Knox aquifer, Cambrian-Ordovician carbonate aquifer, or Crystalline rock aquifers, depending on location.

The Alluvial aquifer underlies the Mississippi River and its tributaries and consists of sand and gravel with interbeds of clay. In 2015, the aquifer supplied 1.9 mgd for public supplies and in 2000, the aquifer supplied 1.34 mgd of water for irrigation (Maupin and Barber 2005). The water quality within the aquifer is generally good but can contain high iron concentrations in some areas. Water from the Alluvial aquifer is used primarily for rural-domestic supplies and some irrigation (Bradley and Hollyday 1985).

The Tertiary sand aquifer conditions are the same as described for the Gleason Reservation in Section 3.6.1.1.3.2. The Cretaceous sand aquifer system conditions are the same as described for the Alternative B transmission corridors in Section 3.6.1.1.3.3. Groundwater within the

Mississippian limestone and dolomite aquifer is the same as described for the CUF reservation in Section 3.6.1.1.1.

The Pennsylvanian sandstone aquifer includes sandstone and conglomerate with fractures, faults, and bedding-plane openings within the rock units bearing the majoring of the water produced. Approximately 0.37 million gallons per day of water is withdrawn from the Mississippian aquifer for public use. The groundwater production within this area is highly variable (Brahana and Bradley 1986; Bradley and Hollyday 1985). General groundwater quality within the Pennsylvanian aquifer is good to excellent and typically has high iron content and some hydrogen sulfide. Water is typically bicarbonate within the aquifer (Brahana and Bradley 1986).

The Ordovician carbonate aquifer system is composed of limestone and dolomite. Water occurs in solution-enlarged openings within the Bigsby, Carters, Ridley and Murfreesboro Limestones, which are the principal water-bearing units within the aquifer. Water is unconfined or partly confined near the surface but may be confined at depth. Approximately 2.4 million gallons per day of water is withdrawn from the Mississippian aquifer for public use. The Ordovician aquifer is connected to the land surface in many areas due to karst features (sinkholes, disappearing streams, and caves) so groundwater in the aquifer can contain high concentrations of nutrients and bacteria (Brahana and Bradley 1986; Bradley and Hileman 2006). General groundwater quality of the Ordovician aquifer is often suitable for drinking water supply, but a wide range of conditions can occur. Areal and stratigraphic variations in water quality have been observed within the aquifer because the system is highly anisotropic and flow within formations is localized (Brahana and Bradley 1986).

Water within the Knox aquifer flows through interconnected solution opening and along bedding planes in the upper two formations of the Knox Group. The Knox aquifer is not utilized for public water supply but is used for domestic water supply where other shallow aquifers do not provide sufficient groundwater. The groundwater quality of the Knox aquifer can be affected by fluoride, sulfate, sulfide gases, and dissolved solids (Brahana and Bradley 1985).

The Cambrian-Ordovician aquifer system is comprised of extensively faulted limestone, dolomite, sandstone, and shales. The primary aquifers are the limestone and dolomite formations, and the principal water-bearing units are carbonate rocks of the Chickamauga Limestone, the Knox Group, and the Honaker Dolomite of the Conasauga Group (Brahana and Bradley 1986). In 2015, 39 mgd of groundwater from the aquifer was utilized for public water supply systems. The water quality is affected by calcium-carbonate, and brines are present at depths below 3,000 feet.

The Crystalline rock aquifer consists of fractured igneous, metamorphic, and metasedimentary rocks with dolomite and limestone present in karst valleys and covers. In 2015, 0.2 mgd of groundwater was utilized from the aquifer for public water systems. Iron and low pH can affect groundwater quality within the crystalline rock aquifer.

3.6.1.2. Environmental Consequences

3.6.1.2.1. The No Action Alternative

Under the No Action Alternative, current operations would continue. TVA would implement the planned actions related to the current and future management and storage of CCRs at CUF, which have either been reviewed or will be reviewed in subsequent NEPA analysis. Groundwater monitoring of CCR impoundments would continue. TVA would continue to work

with the state to obtain and evaluate groundwater quality associated with the CCR management facilities.

TVA would implement supplemental mitigation measures required pursuant to the Administrative Order issued by TDEC in August 2015, as well as the closure plan approved by TDEC, which could include additional monitoring, assessment, corrective action programs, or other actions deemed appropriate as specified in the Environmental Investigation Plan (TVA 2017c). The No Action Alternative would result in a potential for continued impact to groundwater conditions due to ongoing CCR management activities on the CUF Reservation. There would be a small potential for spills to cause cumulative groundwater effects. Such effects would be considered unlikely as the various projects would employ BMPs such as those detailed in spill prevention, control, and countermeasure plans to control for and clean up any spills of chemicals or hazardous materials that could occur. Therefore, potential cumulative effects associated with groundwater are anticipated to be minor.

3.6.1.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Buildings within the deconstruction boundary would be deconstructed and decontaminated to a depth of three feet below grade, which would generate vibrations throughout the course of deconstruction of the buildings and grading and backfilling of the facility. There would be no effects anticipated to the existing groundwater flow pattern. The deconstruction and demolition activities have the potential to release pollutants into the underlying soil and shallow groundwater table. Deconstruction and decontamination activities would be performed in accordance with applicable state regulations and TVA BMPs to limit potential effects to the soil and groundwater. Once deconstruction and decontamination activities are complete, there would be a beneficial effect to the groundwater system because fewer potential contamination sources would remain onsite.

3.6.1.2.3. Alternative A

Proposed construction of a new CC plant and associated equipment may require excavation below the existing ground surface to establish a sub-base and foundation. Potential sources of groundwater effects may exist from the demolition of the existing coal site and the construction of a new CC plant. These potential effects can likely be sufficiently mitigated with the use of appropriate BMPs. The effects of this alternative on groundwater resources are expected to be minor.

3.6.1.2.3.1. Construction and Operation of CC Plant at CUF Plant Site

Water and sewer treatment services are anticipated as on-site needs during construction. Both water and sewer services are currently available at the CUF Reservation. Construction-related water use would support site preparation (including dust control) and grading activities. During earthwork for the grading of access roads, foundations, equipment pads, transmission lines, and other components, the primary use of water would be for compaction and dust control. Smaller quantities would be required for preparation of the equipment pads and other minor uses.

Project activities could potentially cause erosion resulting in the movement of sediment into groundwater infiltration zones. BMPs, such as those described in TVA's *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities* (TVA 2022a), would be used to avoid contamination of groundwater from construction activities. The use of BMPs and a SWPPP would reduce the possibility of any on-site hazardous materials reaching the groundwater during construction and operation. Overall, effects to groundwater are not anticipated.

Water would be utilized for bathrooms for on-site staff. Equipment washing and any potential dust control discharges would be handled in accordance with BMPs for water-only cleaning. Water needs for dust control and bathrooms would not adversely affect groundwater resources based on the anticipated withdrawal rate for the Mississippian carbonate aquifer.

With ongoing CCR management activities on the CUF Reservation, there would be a potential for cumulative effects to groundwater because of the multiple construction projects and associated vehicles in the area. There would be a small potential for spills to cause cumulative groundwater effects. Such effects would be considered unlikely, as the various projects would employ BMPs, such as spill prevention, control, and countermeasure plans, to control for and clean up any spills of hazardous materials that could occur. Therefore, potential cumulative effects associated with groundwater are anticipated to be minor.

3.6.1.2.3.2. Construction and Operation of Natural Gas Pipeline Lateral

The construction and operation of the pipeline is not anticipated to have long-term negative impacts on groundwater quality or supply. General and site-specific groundwater resource impacts and mitigation for the pipeline area are addressed in the following paragraphs. No groundwater withdrawals from public or private water supply wells are currently anticipated during construction or operation of the pipeline. No impacts to sole-source aquifers, public water supply wells, private drinking water supply wells, or wellhead protection areas are anticipated as a result of construction or operation of the pipeline (TGP 2022b).

Water and sewer treatment services are currently not available along the pipeline corridor. However, both are anticipated as on-site needs during construction. Construction-related water use would support site preparation (including dust control), hydrostatic testing, and grading activities. During earthwork for the grading of access roads and construction of the natural gas pipeline lateral, the primary use of water would be for compaction and dust control.

Water used during construction would be provided by delivery via water trucks filled with water from nearby surface waterbodies. If determined necessary, sewer treatment would be accomplished through use of a pump-out septic holding tank. If installed, the septic holding tank would be appropriately permitted and constructed to avoid effects to groundwater. None of the proposed options for water and water-related needs would adversely affect available groundwater resources.

Project activities could potentially cause erosion resulting in the movement of sediment into groundwater infiltration zones. Construction and operation of the pipeline would not interrupt groundwater flow due to the potential for localized erosion. As the gas pipeline lateral would be buried, there is a potential that it may come into contact with groundwater. The use of BMPs and a SWPPP would reduce the possibility of any on-site sediment, chemicals, and hazardous materials reaching the groundwater during construction and operation. Overall, adverse effects to groundwater are not anticipated. No incremental contributions to cumulative impacts on groundwater sources would result from the construction and operation of the pipeline relative to other past, present, or reasonably foreseeable future projects in the area (TGP 2022b).

The primary uses of water during operation and maintenance-related activities would be for possible dust control and hydrostatic testing. The access roads onsite would not be heavily traveled during normal operations, and consequently, water use for dust control is not expected. Water needs during operations and maintenance would be provided by delivery via water trucks and via water uptake from surface waterbodies and would not adversely affect groundwater resources.

As stated in TGP's Resource Report 2 (TGP 2022b):

> TGP has not identified any known areas of existing groundwater contamination within the pipeline area (TDEC 2020a). Groundwater contamination could occur from accidental spills of fuels, solvents, and lubricants used during construction of the [pipeline]. Spill-related impacts will be minimized by implementation of the measures included in TGP's Spill Prevention and Control Plan ("SPCP"), FERC's Upland Erosion Control, Revegetation and Maintenance Plan ("FERC Plan"; FERC 2013a), and FERC's Wetland and Waterbody Construction and Mitigation Procedures ("FERC Procedures"; FERC 2013b), with requested deviations. Among other things, these plans address personnel training, secondary containment design, hazardous substance storage and disposal procedures, refueling areas, spill response procedures, mitigation measures, and BMPs designed to reduce or eliminate potential adverse impacts on groundwater resources. Other appropriate mitigation measures would be implemented during construction, in accordance with applicable permitting and regulatory requirements.

Pipeline construction activities could affect groundwater resources, but "most potential impacts would be avoided or minimized by the use of both standard and specialized construction techniques. [The aquifer] could sustain minor temporary impacts from changes in overland water flow and recharge caused by clearing and grading of the proposed [pipeline] ROW. The ROW would be restored to pre-construction contours in accordance with the FERC Procedures (with any approved deviations). In forested areas, water infiltration, which is normally enhanced by vegetation, would be reduced until vegetation is re-established. In addition, near-surface soil compaction caused by heavy construction vehicles could reduce the ability of soil to absorb water" (TGP 2022b). In areas where forest is permanently converted to maintained grasses/herbs and shrubs, infiltration may be permanently reduced. To a large extent, these minor impacts would be temporary in nature and will not significantly affect groundwater resources. Impacted areas would be returned to pre-construction conditions to the extent practicable, by revegetation and decompaction after all [construction activities] have ceased in the area" (TGP 2022b).

According to TGP's Resource Report 2 (TGP 2022b):

> Typical groundwater depths across the [pipeline area] are highly variable and range from relatively shallow depths of <5 feet bgs to >150 feet bgs in some areas. The average depth to water is 40 feet bgs across all three counties. The pipeline would be installed at a minimum depth of five feet below the center of roadways or as required by applicable crossing permits and approvals and would be designed to withstand anticipated external loadings. Trenching and backfilling could potentially cause minor localized fluctuations in groundwater levels, and/or increased turbidity within the zone of shallow groundwater adjacent to the trench. Groundwater disturbance would be temporary and localized to the immediate area of the trenching and backfilling activity and is not anticipated to affect the overall quality of groundwater in the [pipeline] area. Because groundwater could be encountered during trenching associated with the proposed pipeline, TGP would conduct trench dewatering in accordance with the FERC Plan, TDEC regulations, and applicable federal, state, and local permits.

TGP would strictly adhere to all federal, state, and local regulations applicable to controlled blast, and blast vibration limits with regard to structures and underground utilities while performing blasting activities. Special care would be taken to monitor and assess blasting within 250 feet of dwellings and 150 feet of private or public water supply wells (TGP 2022f). Additional information regarding blasting is addressed in Resource Report 6, *Geological Resources* and TGP's Draft Blasting Plan.

Turbidity levels in shallow groundwater in proximity to blasting activities could potentially increase, but elevated levels are not expected outside of the immediate vicinity of the blasting and would likely only occur over a short period of time following the blasting. Sediments will disseminate on the ground surface and filter through substrate material prior to transport. Vibrations from blasting could potentially cause minor sediment influx in nearby wells but TGP will adhere to the considerations for public and private groundwater resources as outlined in the Blasting Plan. These effects may be more likely in karst areas, where carbonate rock weathering is prevalent and fine-grained sediments have settled into void-structures of the shallow rock, but significant increases of turbidity in groundwater are not expected outside of the immediate blasting area and any potential occurrences would be only for a short duration.

According to TGP's Resource Report 2 (TGP 2022b):

> No significant impacts are anticipated to occur to groundwater resources from construction and operation of the [pipeline]. Potential impacts on groundwater resources would be avoided or minimized by the use of both standard and specialized pipeline construction techniques. Dewatering may be necessary in areas where there is a high-water table. However, phased pipeline construction activities within a particular location are typically completed within several days, and any lowering of localized groundwater from pumping and dewatering would be temporary. To recharge the aquifer and prevent silt-laden waters from flowing into waterbodies and wetlands, TGP will discharge water from dewatering activities into well-vegetated upland areas through filter bags or dewatering structures. Implementation of these procedures would minimize groundwater impacts during dewatering operations. TGP will conduct construction activities in accordance with the FERC Plan to minimize potential impacts to groundwater in the vicinity of the [pipeline].

Prior to construction, TGP would seek landowner permission to conduct pre- and post-construction monitoring of water quality and yield for all wells within the appropriate buffer zones using a qualified, independent contractor. TGP would offer to conduct pre- and post-construction water sampling for all public and private groundwater supply wells and potable springs within a) 150 feet of the pipeline construction ROW or additional temporary workspace where no karst terrain is present, or b) 1,000 feet where karst terrain is present. TGP would also offer to conduct pre- and/or post-construction water sampling for all municipal and public groundwater wells within 400 feet of the pipeline corridor (TGP 2022f).

Significant effects to groundwater resources as a result of construction-related activities are not anticipated. "There are no USEPA-designated sole-source aquifers in the vicinity of the [pipeline] area. Additionally, TDEC has been contacted to confirm that there are no state or local wellhead protection areas within one mile of the [pipeline]. No impacts to sole-source aquifers, public water supply wells, private drinking water supply wells, or wellhead protection areas are anticipated as a result of the construction or operation of the pipeline. No groundwater withdrawals are being proposed for construction activities and no groundwater withdrawals will

be required during operation of the [pipeline]; therefore, no impacts related to groundwater withdrawal will occur as a result of its construction or operation.

"A review of pipeline project-specific past, current, and proposed projects located within HUC 12 watersheds crossed by the [pipeline] (as summarized in Table 3.1-1 in Section 3.1) was completed by TGP (TGP 2022a) to assess the cumulative impacts to groundwater resources in the [pipeline] area. In total, 10 past, current, and future projects were identified within the Cumberland Impact Assessment Area (CIAA) impact area for water resources. Two of the identified projects, Cumberland River Compact ILF Program Instrument and Hayes Fork Wetland Mitigation Bank, are habitat restoration projects with no negative impacts to groundwater resources. In addition, the Magnum Manufacturing Expansion has been completed with no reported impacts to groundwater resource documented on any public forum, and the CUF Wastewater Treatment Facility anticipated no potential impacts to groundwater resources (TVA 2019c). The Dickson County Municipal Airport Lighting Upgrade Projects does not require any additional construction or subterranean activities; therefore, no groundwater should be impacted by [the pipeline] project" (TGP 2022f). Potential minor, localized impacts to seasonal surficial groundwater patterns were anticipated from the CUF Borrow Areas and Access Road project (TVA 2017b). The remaining four projects could result in negative impacts to groundwater resources; however, no quantifiable information was found on any public forum regarding their possible groundwater impacts. Impacts to groundwater from these activities have been or will be similar to those of the proposed pipeline and represent an insignificant risk to groundwater (TGP 2022f). "Therefore, no incremental contributions to cumulative impacts on groundwater sources will be anticipated relative to other past, present, or reasonably foreseeable future projects in the area" (TGP 2022f).

3.6.1.2.3.3. Transmission and Other Components

Effects to water resources within the CUF Reservation for transmission improvements would be the same as those listed in Section 3.6.1.2.3.1.

3.6.1.2.3.4. Summary of Alternative A

Proposed construction of a new CC plant and associated equipment would require excavation below the existing ground surface to establish a sub-base and foundation. Potential sources of groundwater effects may exist from the demolition of the existing coal site and the construction of a new CC plant. These potential effects can likely be sufficiently mitigated with the use of appropriate BMPs. Additionally, sink holes and other karst features would be identified and either protected with buffer zones or grouted appropriately. The effects of this alternative on groundwater resources are expected to be minor.

The construction activities required for a new CC plant could potentially cause erosion resulting in the movement of sediment into groundwater infiltration zones. BMPs, such as those described in TVA's *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities* (TVA 2022a), would be used to avoid contamination of groundwater from construction activities. The use of BMPs and a SWPPP would reduce the possibility of any on-site hazardous materials reaching the groundwater during construction and operation. Overall, effects to groundwater are not anticipated.

The construction and operation of the pipeline is not anticipated to have long-term negative impacts on groundwater quality or supply. Significant effects to groundwater resources as a result of construction-related activities are not anticipated. There are no USEPA-designated sole-source aquifers in the vicinity of the pipeline area. No groundwater withdrawals from public or private water supply wells are currently anticipated during construction or operation of the

pipeline. No impacts to sole-source aquifers, public water supply wells, private drinking water supply wells, or wellhead protection areas are anticipated as a result of construction or operation of the pipeline (TGP 2022b).

3.6.1.2.4. Alternative B

Under the Proposed Action Alternative B, CUF would be retired and demolished as with Alternative A.

3.6.1.2.4.1. Construction and Operation of CT Plant at JCT Reservation

Water and sewer treatment services would be required onsite during construction. Both water and sewer services are currently available at the JCT Reservation. Construction employees would require port-a-potties within the construction site, which would be serviced by a third-party contractor for off-site disposal. Construction-related water use would support site preparation (including dust control) and grading activities. During earthwork for the grading of access roads, foundations, equipment pads, and other components, the primary use of water would be for compaction and dust control. Smaller quantities would be required for preparation of the equipment pads and other minor uses.

Project activities could potentially cause erosion resulting in the movement of sediment into groundwater infiltration zones. Sink holes and other karst features would be identified and either protected with buffer zones or grouted appropriately. TVA's BMPs (TVA 2022a) would be used to avoid contamination of groundwater from Project activities. The use of BMPs and a SWPPP would reduce the possibility of any on-site hazardous materials reaching the groundwater during construction and operation. Overall, effects to groundwater are not anticipated.

Demineralized water currently available at the JCT Reservation would be used for the proposed CTs. Potable water would be obtained from the existing public supply. Therefore, no effects to groundwater associated with operation of the CT plant are anticipated.

No cumulative effects to groundwater are anticipated associated with the adjacent Aeroderivative CT project. With the use of proper BMPs, indirect or cumulative effects to groundwater would be temporary and minor.

3.6.1.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

Construction-related water needs for the CT plant would be the same as those described for the CT plant at JCT in Section 3.6.1.2.4.1. Demineralized water currently available at the Gleason Reservation would be used for the proposed CTs. Potable water would be obtained from the existing public supply. Therefore, no effects to groundwater associated with operation of the CT plant are anticipated.

3.6.1.2.4.3. Transmission and Other Components

Shallow excavation may be required for the proposed transmission line. If groundwater is encountered, dewatering activities would be used to control groundwater infiltration into the excavation site and all state and federal requirements relating to groundwater protection would be followed. However, because such activities and their effects to groundwater patterns or availability are localized and generally limited to the construction phase, effects from construction are expected to be minor. During revegetation and maintenance activities, effects to groundwater would be minor and mitigated through use of BMPs (TVA 2022a). As such, effects to groundwater associated with the transmission line would be minor.

3.6.1.2.5. Alternative C

3.6.1.2.5.1. Construction and Operation of Solar and Storage Facilities

Water and sewer treatment services are currently not available at many of the possible solar and storage facility locations. However, both are anticipated as on-site needs during construction. Construction-related water use would support site preparation (including dust control) and grading activities. During earthwork for the grading of access roads and construction of the transmission corridor, the primary use of water would be for compaction and dust control.

Water used during construction would be delivered by water trucks and, if necessary, project water wells. If needed, sewer treatment would be accomplished through use of a pump-out septic holding tank. If installed, the septic holding tank would be appropriately permitted and constructed to avoid effects to groundwater. The proposed options for water and water-related needs would not be likely to adversely affect available groundwater resources.

Project activities could potentially cause erosion resulting in the movement of sediment into groundwater infiltration zones. Sink holes and other karst features would be identified and either protected with buffer zones or grouted appropriately. TVA's BMPs (TVA 2022a) would be used to avoid contamination of groundwater from construction activities. The use of BMPs and a SWPPP would reduce the possibility of any on-site hazardous materials reaching the groundwater during construction and operation. Overall, effects to groundwater are not anticipated.

The primary uses of water during operation and maintenance-related activities would be for onsite maintenance facilities. Precipitation in the area is typically adequate to minimize the buildup of dust and other matter on the PV panels that would reduce energy production; therefore, no regular panel washing is anticipated. Battery storage sites may require water for sprinkler facilities for fire suppression. Depending on the battery type and manufacturer, other means of fire protection, including chemical agents, may be utilized instead. Water needs during operations and maintenance would be provided either via the proposed Project wells also used during construction or by delivery via water trucks and would not adversely affect groundwater resources.

Cumulative effects to groundwater associated with the expansion of solar facilities under the 2019 IRP are not anticipated with the use of BMPs.

3.6.1.2.5.2. Transmission and Other Components

Transmission lines associated with solar and BESS facilities would have the same effect on groundwater as described in Section 3.6.2.2.4.3.

3.6.2. Surface Water and Water Quality

Surface water is any water that flows above ground and includes, but is not limited to, streams, ponds, lakes, and wetlands. Streams can be further classified as perennial, intermittent, or ephemeral based on the occurrence of surface flow. Wetlands are discussed in Section 3.6.3.

The CWA is the primary law that governs surface waters and water quality. It establishes standards for the quality of surface waters and prohibits the discharge of pollutants from point sources unless a NPDES permit is obtained. NPDES permits also address CWA Section 316(b) requirements for the design, location, construction and capacity of cooling water intakes to reflect the best technology available for minimizing environmental impact as well as Section 316(a) requirements for effluent limitations on thermal discharges to assure maintenance of a

balanced indigenous population of fish and wildlife. Section 404 of the CWA further prohibits the discharge of dredge and fill material to waters of the United States, which include many wetlands, unless authorized by a permit issued by the USACE. Certification from Tennessee would also be sought to verify that the permitted discharges comply with the state's applicable effluent limitations, antidegradation, and water quality standards. If approved, the TDEC Division of Water Resources would issue this Section 401 water quality certification for dredge or fill of federally regulated waters. Alterations to state regulated waters would be authorized by a TDEC issued ARAP (TDEC 2019b).

The seven states in the TVA power service area have enacted laws regulating water quality and implementing the CWA. As part of this implementation, the states classify water bodies according to their uses and establish water quality criteria specific to these uses. Each state has also issued an antidegradation statement containing specific conditions for regulated actions and designed to maintain and protect current uses and water quality conditions.

3.6.2.1. Affected Environment

3.6.2.1.1. CUF Reservation

Field surveys for surface waters were conducted by TVA and its contractors in July and August 2021 (Appendix E). In addition to the Cumberland River, a total of eight (8) perennial streams (totaling 12,592 linear feet [lf]), five (5) intermittent streams (totaling 7,332 lf), five (5) ponds (29.7 acres), and fourteen (14) ephemeral streams (totaling 10,485 lf) were documented within the CUF Reservation. Figure 3.6-1 depicts the delineated surface waters, which are discussed in the sections below. Named waterbodies and their use classifications are also provided.

The CWA requires all states to identify waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards and to establish priorities for the development of limits based on the severity of the pollution and the sensitivity of the established uses of those waters. States are required to submit reports to USEPA with these data. The term "303(d) list" refers to the list of impaired and threatened streams and water bodies identified by the state. The Cumberland River is not listed as impaired or threatened in Tennessee (TDEC 2022).

Wells Creek borders the south and west sides of the CUF plant and bisects the study area. This stretch of Wells Creek was added to Tennessee's list of impaired waters in 2020 due to high bacterial load (*Escherichia coli* [*E. coli*]) from sanitary sewer overflows (TDEC 2020a), and remains on the 2022 303(d) list (TDEC 2022). The surrounding wetlands have the potential to reduce nutrient levels and retention in surrounding streams, thus improving water quality.

The Lower Cumberland River from the Kentucky-Tennessee state-line (Cumberland River Mile [CRM] 74.6, approximately 28 miles downstream of CUF) to Cummings Creek (CRM 118.3, approximately 15 miles upstream of CUF) is classified for use for domestic and industrial water supply, fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. The entire length of Wells Creek is classified for use for fish and aquatic life, recreation, livestock watering and wildlife, and irrigation (TDEC 2019a). No Nationwide Rivers Inventory streams or Wild and Scenic Rivers[7] are located near the CUF Reservation. Scott Branch adjacent to CUF has not

[7] Nationwide Rivers Inventory is a listing of more than 3,200 free-flowing river segments that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be at least regionally significant. Rivers included in the Nationwide Rivers Inventory are candidates for Wilde and Scenic Rivers, which are protected under the National Wild and Scenic Rivers System created by

been assessed; per the TDEC Use Classifications for Surface Waters, all other surface waters that have not been specifically noted are classified for aquatic life, recreation, livestock watering and wildlife, and irrigation (TDEC 2019a).

The Cumberland River downstream of CUF is subject to the influence of the thermal discharges from the coal units' cooling system. Under normal conditions, the Cumberland River flow near CUF is primarily dependent upon releases from the USACE Cheatham Dam located approximately 46 miles upstream, and to a lesser extent by downstream releases from Barkley Dam and tributary inflows upstream of the plant.

CUF is drained by permitted storm water outfalls, wet weather conveyances, the closed cooling water (CCW) discharge (Outfall 002), and process and storm water discharges from the Main Ash Impoundment (Internal Monitoring Point [IMP]) 001. The CCW Outfall 002 discharges to the Cumberland River at CRM 102.8. The plant intake is located approximately at CRM 103.2 and withdraws water for cooling and process purposes (TDEC 2018).

An average of 2,096 MGD of CCW is withdrawn through a surface water intake structure from the Cumberland River. Approximately 98 percent of the 2,096 MGD of CCW withdrawals are used for cooling purposes and approximately 2 percent for plant process water uses (e.g., sluice water, fire protection, boiler feed water, safety eye wash and showers, and miscellaneous wash water) before being returned to the river after appropriate treatment and in compliance with CUF's NPDES permit.

The IMP 001 discharge to the CCW channel has an average flow of 21.7 MGD and details tiered compliance, with Tier 1 having limits and reporting of discharges from existing CCR impoundments and during CCR impoundment dewatering and Tier 2 details discharges from lined process water basin(s). TVA is required under NPDES Permit No. TN0005789 to meet pH, total suspended solids (TSS), and oil and grease limits at this discharge. The NPDES permit also requires that IMP 001 be monitored for a series of constituents. For Tier 1, this includes antimony, aluminum, arsenic, barium, beryllium, boron, calcium, cadmium, chromium, cobalt, copper, lead, lithium, mercury (Hg), molybdenum, nickel iron, manganese selenium, silver thallium, and zinc. Total dissolved solids, total ammonia (as nitrogen), chloride, sulfate, radium 228 and radium 229, and fluoride must also be sampled, analyzed, and reported for IMP 001 (TDEC 2018). Tier 2 has the same requirements as Tier 1 except removes the requirements to monitor some total metals including boron, calcium, cobalt, lithium, and molybdenum. Total dissolved solids, chloride, sulfate, radium 228 and radium 229, and fluoride requirements were also removed.

Congress in 1968 with the goal of "preserving certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations."

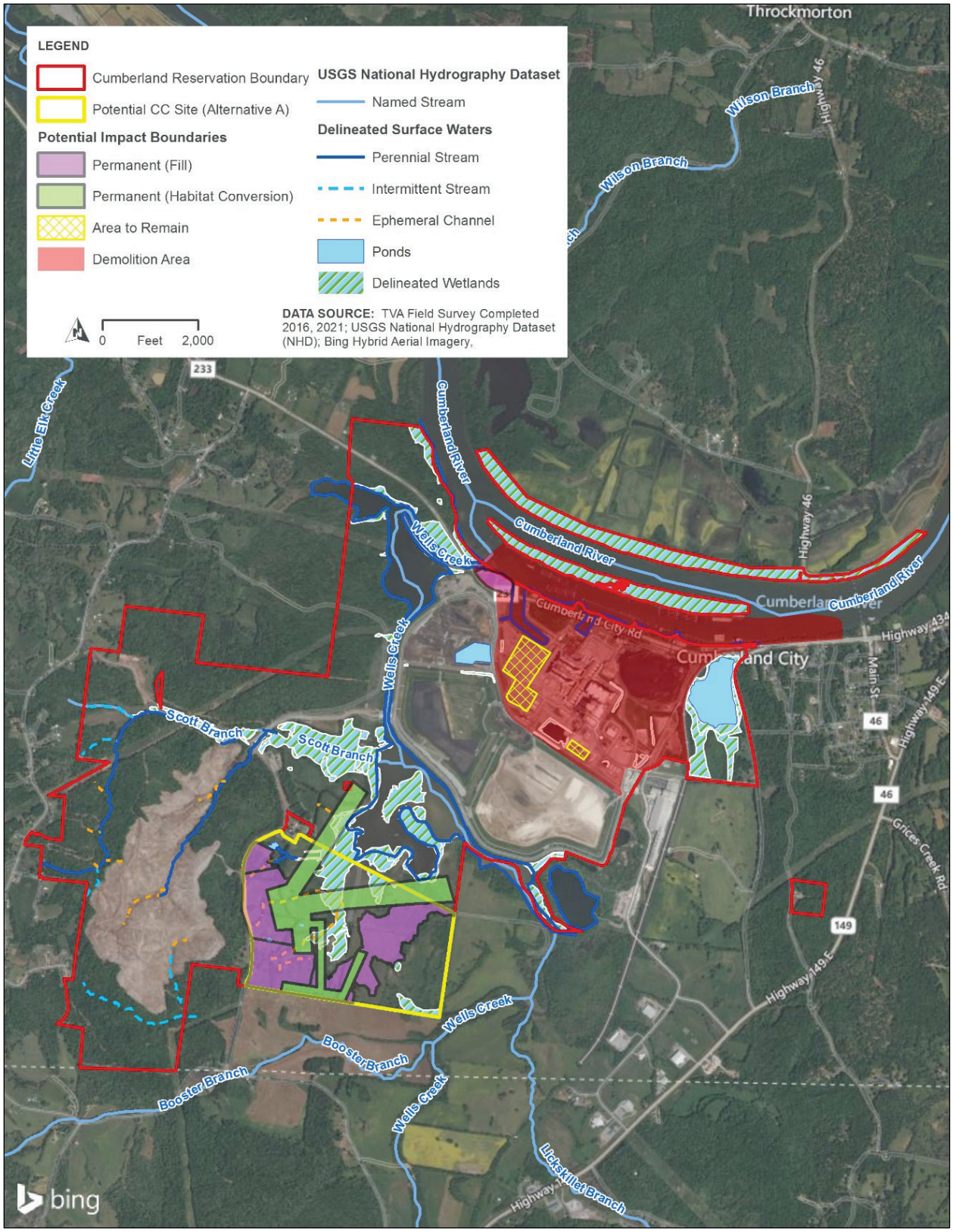

Figure 3.6-1. Surface water and wetland features of the Cumberland Reservation

3.6.2.1.2. Alternative A

3.6.2.1.2.1. Proposed CC Plant

A review of the data collected during July and August 2021 for the proposed CC plant identified two perennial streams, five ephemeral streams/wet-weather conveyances (WWC), and three ponds site A2 (Figure 3.6-1). In a letter dated August 12, 2022, TDEC concurred with TVA's hydrologic determinations for streams and conveyances on the proposed CC plant site. On November 4, 2022, the USACE (2022b) also provided an Approved Jurisdictional Determination (AJD) and Preliminary Jurisdictional Determination (PJD) for waters on the A2 site, including those that fall within the disturbance footprint. Consultations with TDEC and USACE are included in Appendix E. The two perennial streams are tributaries to Scott Branch and total 922 lf. The ephemeral channels/WWCs total 4,513 lf on the proposed CC plant site, however two of these are considered non-jurisdictional by the USACE. Like Scott Branch, the perennial tributaries are also not listed on TDEC's Use Classifications for Surface Waters (TDEC 2019a) and therefore are classified for fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. Neither Scott Branch nor tributaries to Scott Branch are listed on the draft 2022 303(d) list of impaired and threatened waters (TDEC 2022).

A portion of Wells Creek also falls within the transmission corridor boundary for Alternative A. As discussed above, Wells Creek was added to Tennessee's list of impaired waters in 2020 due to high bacterial load (*E. coli*) from sanitary sewer overflows (TDEC 2020a) and remains on the 2022 303(d) list.

3.6.2.1.2.2. Natural Gas Pipeline Corridor

The pipeline corridor crosses Dickson, Houston, and Stewart counties. Field surveys conducted by TGP between June 2021 and April 2022 identified 149 waterbody crossings within the pipeline corridor, consisting of 79 ephemeral channels, 35 intermittent streams, 35 perennial streams, and no ponds (TGP 2022a) (Table 3.6-1, Appendix E). Some waterbodies cross the corridor at multiple locations. Substrates of ephemeral channels were predominantly silt/clay and organic material while the intermittent and perennial streams were characterized by bedrock, cobble, and gravel substrates. Fish, amphibians, and benthic macroinvertebrate populations were also identified in some streams.

Table 3.6-1. Surface Waters Crossed by the Alternative A Natural Gas Pipeline Corridor

Flow Regime	County	Number of Waterbody Crossings	Waterbody Width (feet)[1]
Ephemeral	Dickson	42	134.5
	Houston	37	159.5
Intermittent	Dickson	22	142.5
	Houston	13	152.5
Perennial	Dickson	27	622
	Houston	7	192
	Stewart	1	60
Total		**149**	**1,463**

Source: TGP (2022a)

1) Waterbody width indicates the cumulative width of all waterbody crossing of each flow regime per county.

Of the 149 waterbodies crossed by the natural gas pipeline corridor, 20 streams are named. Generally, named and unnamed streams not specifically included in TDEC's (2019a) designated use classifications list are classified for fish and aquatic life (FAL), recreation (REC), livestock watering and wildlife (LWW), and irrigation (IRR). Four other named waterbodies also have additional classifications. The named streams and designated uses are listed in Table 3.6-2 and depicted on figures provided in Appendix E.

Table 3.6-2. Designated Use Classifications for Streams in the Vicinity of the Alternative A Natural Gas Pipeline Corridor

Stream	Use Classification[1]						
	FAL	REC	LWW	IRR	TS	IWS	NRTS
Bartons Creek	X	X	X	X			
Dry Hollow Branch	X	X	X	X			
Furnace Creek	X	X	X	X			X
Gafford Branch	X	X	X	X			
Guices Branch	X	X	X	X			
Guices Creek	X	X	X	X			
Harris Branch	X	X	X	X			
Indian Branch	X	X	X	X			
Johnson Creek	X	X	X	X			
Jones Creek	X	X	X	X		X	
Jordan Branch	X	X	X	X			
Leatherwood Creek	X	X	X	X			
Lickskillet Branch	X	X	X	X			
Little Bartons Creek	X	X	X	X			
Miller Branch	X	X	X	X			
Nesbitt Branch	X	X	X	X			
Porters Branch	X	X	X	X	X		
Upper Sugarcamp Branch	X	X	X	X			
Wells Creek	X	X	X	X			
Yellow Creek	X	X	X	X	X		

Source: TDEC 2019a; TGP 2022a
[1] Codes: FAL= Fish and Aquatic Life; REC = Recreation; LWW = Livestock Watering and Wildlife; IRR= Irrigation; TS= Trout Stream; IWS= Industrial Water Supply; and NRTS= Naturally Reproducing Trout Stream. All other named streams unnamed tributaries not specifically referenced in TDEC (2019) are classified FAL, REC, LWW, and IRR.

Waterbodies within the pipeline corridor were considered "sensitive" waterbodies when they meet the following criteria:

- Do not meet state water quality standards;
- Surface waters that have been designated for intensified water quality management and improvement;
- Waterbodies that contain threatened or endangered species or critical habitat;
- Waterbodies that are crossed less than three miles upstream of a potable water intake;
- Outstanding or exceptional quality waterbodies;
- Waterbodies of particular ecological and recreational importance;

- Waterbodies located in sensitive and protected watershed areas;
- Waterbodies and intermittent drainages that have steep banks, potentially unstable soils, high volume flows, and actively eroding banks;
- Surface waters that have important riparian areas; and
- Any waterbodies afforded national or state status for exceptional quality, and waterbodies listed on the NRI.

As stated in TGP's Resource Report 2 (TGP 2022b):

> Other factors that can provide a basis for sensitivity include the location of a waterbody within a protected watershed, steep banks, and other characteristics that might contribute to high risk of erosion impacts, and the presence of important riparian areas.
>
> Two waterbodies listed on the National Rivers Inventory (NRI) for outstanding or exceptional quality include Jones Creek and Yellow Creek. The NRI designates free-flowing river segments in the U.S. that possess outstandingly remarkable natural and/or cultural values, which are of national significance (NPS 2022). The NRI is maintained by the National Park Service (NPS) as a list of river segments that potentially qualify as national wild, scenic, or recreational river areas and requires federal agencies to avoid or mitigate actions that would adversely impact any NRI segments. "Jones Creek is listed on the NRI for its outstandingly remarkable fish, geologic, recreational, scenic, and wildlife value, and Yellow Creek is listed for its outstandingly remarkable fish, recreational, and scenic value (NPS 2022). Jones Creek is a high-quality perennial stream that is 40 ft wide and 2 ft deep with a summer mean flow of 63.9 cfs where it crosses the pipeline corridor. The substrate is composed of bedrock, cobble, and silt/clay. The area surrounding Jones Creek is a mixture of forested uplands and agricultural pastures currently utilized for soybean cultivation. A healthy population of fish, crayfish, macrobenthos, and amphibian species was observed in the stream at the time of survey.
>
> Yellow Creek is a high-quality perennial stream that is 111 ft wide and 6 ft deep with a summer mean flow of 86.1 cfs [at the pipeline corridor]. The substrate is composed of cobble, bedrock, gravel, and riprap. The area surrounding Yellow Creek is a mixture of forested uplands, agricultural pastures, and residential housing. A healthy population macrobenthos, crayfish, amphibians, and fish including bass, sunfish, perch, and various minnow species were noted at the time of survey.

Jones Creek, three unnamed tributaries to Jones Creek, and Little Bartons Creek, which cross the pipeline corridor in Dickson County, and Wells Creek that crosses the corridor in Stewart and Houston counties, are considered sensitive waterbodies as they are not currently meeting state water quality standards and are listed as impaired (Table 3.6-3) (TDEC 2022; TGP 2022b). Jones Creek is listed for several causes and potential sources. Little Bartons Creek and Wells Creek are listed for *E. coli* due to sanitary sewer overflows in Dickson, Stewart, and Houston counties.

Table 3.6-3. Streams in the Vicinity of the Alternative A Natural Gas Pipeline Corridor included on the TDEC 303(d) List of Impaired Waters

Stream	County	Cause for Listing	Potential Source
Jones Creek	Dickson	*E. coli*	Grazing in riparian or shoreline zones Municipal point source discharges
		Nitrate/Nitrite	Grazing in riparian or shoreline zones Municipal point source discharges
		Total Phosphorus	Grazing in riparian or shoreline zones Municipal point source discharges
		Sedimentation/Siltation	Site clearance (land development)
		Alteration in Stream-side or Littoral Vegetative Covers	Site clearance (land development)
		Nutrients	Grazing in riparian or shoreline zones Site clearance (land development)
Unnamed Tributaries to Jones Creek (N=3)	Dickson	Flow Regime Modification	Dam or impoundment
		Other Anthropogenic Substrate Alterations	Dam or impoundment, golf courses
		Sedimentation/Siltation	Golf courses
		Alteration in Stream-side or Littoral Vegetative Covers	Municipal (urbanized high-density area)
		Physical Substrate Habitat Alterations	Channelization
Wells Creek	Stewart	*E. coli*	Sanitary sewer overflows
	Houston	*E. coli*	Sanitary sewer overflows

Source: TDEC (2022)

No streams designated as Exceptional Tennessee Waters or Outstanding National Resource Waters were identified within one mile of the natural gas pipeline corridor.

3.6.2.1.3. Alternative B

3.6.2.1.3.1. Johnsonville Reservation

The JCT Reservation is located on the east bank of the Kentucky Reservoir of the Tennessee River. Kentucky Reservoir is included on Tennessee's list of impaired waters due to low dissolved oxygen (DO) from upstream impoundment (TDEC 2022). No streams occur on the proposed CT plant site (Figure 3.6-2).

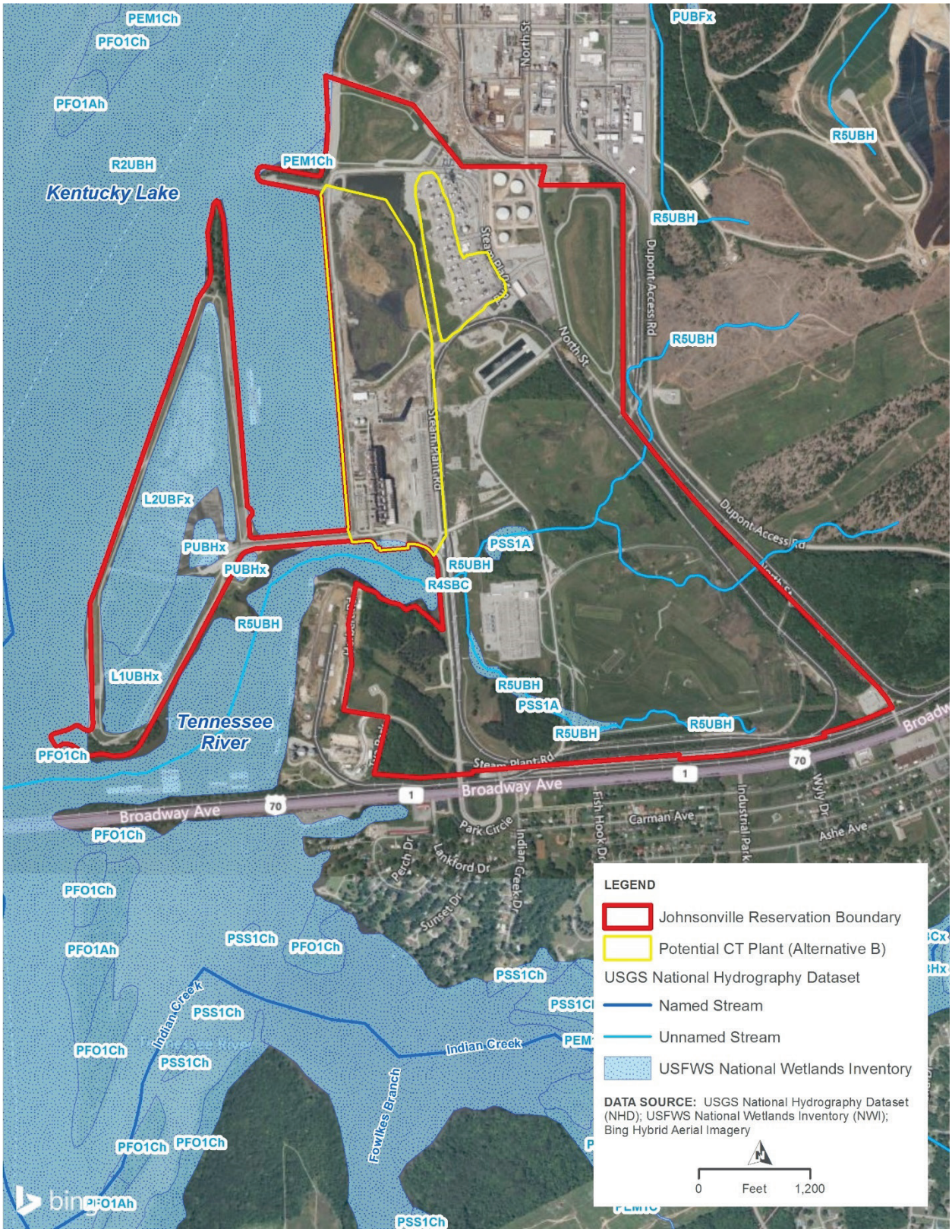

Figure 3.6-2. Surface waters on and in the vicinity of the Johnsonville Reservation

3.6.2.1.3.2. Gleason Reservation

Based on the NHD, one intermittent stream crosses the Gleason Reservation and ultimately flows to the Middle Fork Obion River (Figure 3.6-3). Approximately 1,618 lf of this intermittent stream is on the CT plant site.

Gleason is in the Southeastern Plains ecoregion. Streams in this ecoregion have higher gradients as compared to the loess plain and primarily sandy substrates (Etnier and Starnes 1993). Extensive agricultural practices over the past several decades have channelized the nearby Middle Fork Obion River and surrounding tributaries, resulting in little natural habitat for aquatic species. The nearby Middle Fork Obion River is currently listed on the TDEC 303(d) list for impairment due to physical substrate habitat alterations, sedimentation/siltation, *E. coli*, nitrate/nitrite, and total phosphorus related to river channelization, crop production, municipal point sources, and non-point sources (TDEC 2022). The Middle Fork Obion River is classified for use for fish and aquatic life, recreation, livestock watering and wildlife, and irrigation (TDEC 2019a).

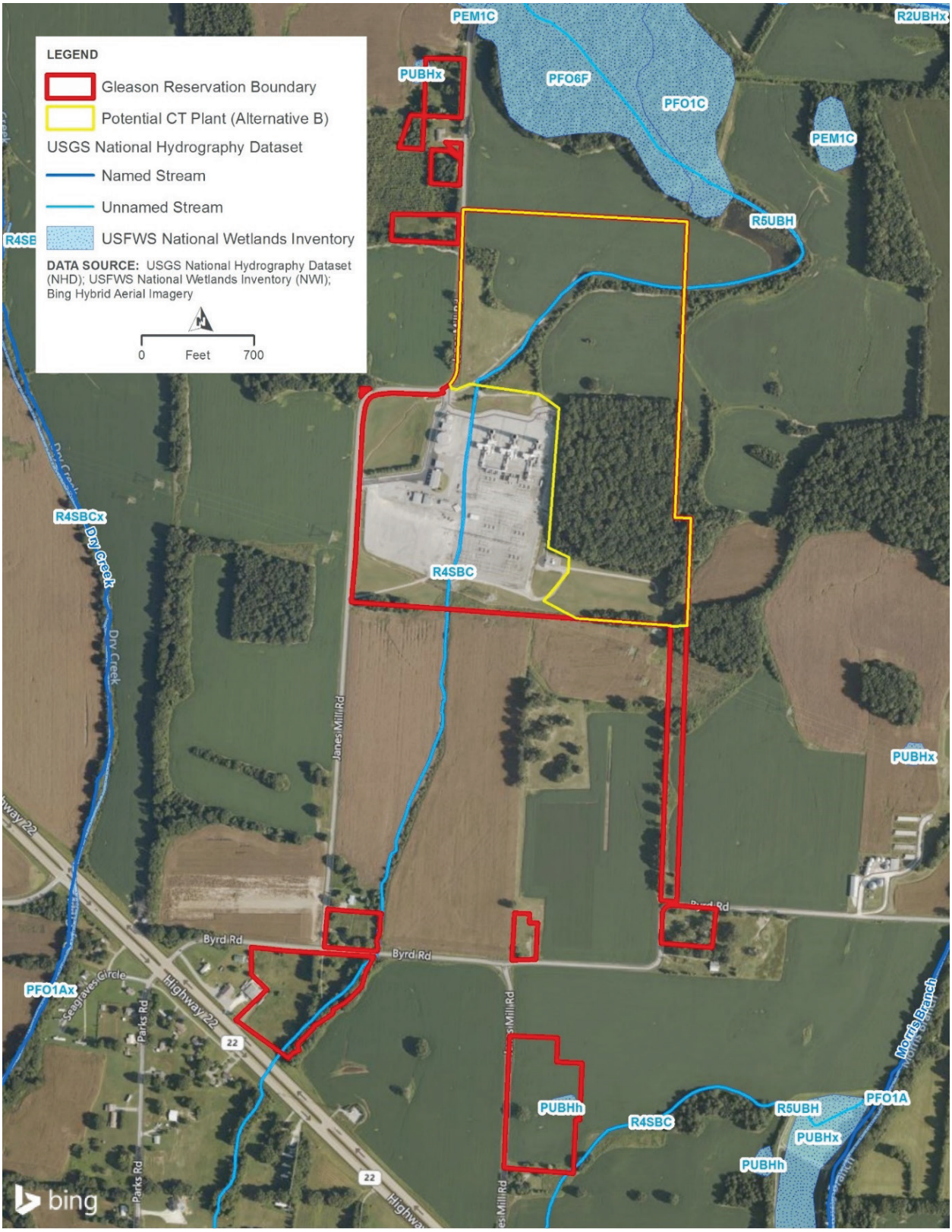

Figure 3.6-3. Surface water features of the proposed CT plant site within Gleason Reservation

3.6.2.1.3.3. Transmission Corridors

The 40-mile transmission line corridor crosses Weakley and Henry counties. A desktop review of the NHD identified eight streams and tributaries crossing the transmission corridor. These are listed, along with their designated uses, in Table 3.6-4. Of the named streams, Cane Creek, Cypress Creek, East Fork Clarks River, Mayo Branch, and North Fork Obion River are listed on the USEPA 303(d) list of impaired and threatened waters (TDEC 2022) for Weakley and Henry counties. Causes for listing and potential sources are provided in Table 3.6-5.

Table 3.6-4. Designated Uses of Streams in the Vicinity of the Alternative B Transmission Corridor

Stream	Use Classification[1]				
	FAL	REC	LWW	IRR	NRTS
Cane Creek	X	X	X	X	
Chestnut Branch	X	X	X	X	X
Cypress Creek	X	X	X	X	
East Fork Clarks River	X	X	X	X	
Holly Fork Creek	X	X	X	X	
Little Cane Creek	X	X	X	X	
Mayo Branch	X	X	X	X	
North Fork Obion River	X	X	X	X	

[1] Codes: FAL= Fish and Aquatic Life; REC = Recreation; LWW = Livestock Watering and Wildlife; IRR= Irrigation; TS= Trout Stream; IWS= Industrial Water Supply; and NRTS= Naturally Reproducing Trout Stream

Table 3.6-5. Streams in the Vicinity of the Alternative B Transmission Corridor included on the USEPA Approved List of Impaired Waters

Stream	County	Cause for Listing	Potential Source
Cane Creek	Weakley	Sedimentation/Siltation	Surface mining
			Grazing in riparian or shoreline zones
		Nitrate/Nitrite	Crop production (non-irrigated)
			Municipal point source discharges
		Total Phosphorus	Municipal point source discharges
			Crop production (non-irrigated)
		Physical Substrate Habitat Alterations	Municipal (urbanized high-density area)
		E. coli	Municipal (urbanized high-density area)
Cypress Creek	Weakley	Physical Substrate Habitat Alterations	Channelization
			Crop production (non-irrigated)
		Nitrate/Nitrite	Grazing in riparian or shoreline zones
		Alteration in Stream-side or Littoral Vegetative Covers	Crop production (non-irrigated)
			Grazing in riparian or shoreline zone
		Dissolved Oxygen	Crop production (non-irrigated)
		Total Phosphorus	Crop production (non-irrigated)
			Grazing in riparian or shoreline zones
		E. coli	Grazing in riparian or shoreline zones

Stream	County	Cause for Listing	Potential Source
East Fork Clarks River	Henry	Physical Substrate Habitat Alterations	Crop production (non-irrigated)
Mayo Branch	Weakley	Alteration in Stream-side or Littoral Vegetative Covers	Crop production (non-irrigated)
		Physical Substrate Habitat Alterations	Crop production (non-irrigated)
North Fork Obion River	Weakley	*E. coli*	Municipal (urbanized high-density area) Source unknown
		Sedimentation/Siltation	Crop production (non-irrigated) Channelization
		Physical Substrate Habitat Alterations	Channelization
		Total Phosphorus	Municipal (urbanized high-density area) Industrial point source discharge Crop production (non-irrigated) Municipal point source discharges

Source: TDEC 2022

3.6.2.1.4. Alternative C

3.6.2.1.4.1. Middle Tennessee TVA PSA

Major watersheds in the Middle Tennessee area include the Tennessee River basin, most of the Cumberland River basin, and portions of the Green River basin. Fresh water abounds in much of this area and generally supports most beneficial uses, including fish and aquatic life, public and industrial water supply, waste assimilation, agriculture, and water-contact recreation, such as swimming.

Tennessee River Basin

The Tennessee River basin contains all except one of TVA's dams and covers about half of the TVA PSA. A series of nine locks and dams built mostly in the 1930s and 1940s regulates the entire length of the Tennessee River and allows navigation from the Ohio River upstream to Knoxville (TVA 2004). Almost all the major tributaries have at least one dam, creating 14 multi-purpose storage reservoirs and seven single-purpose power reservoirs. The construction of the TVA dam and reservoir system fundamentally altered both the water quality and physical environment of the Tennessee River and its tributaries. While dams promote navigation, flood damage reduction, power generation, water supply, water quality, and river-based recreation by moderating the flow effects of floods and droughts throughout the year, they also disrupt the daily, seasonal, and annual flow patterns characteristic of a river. This system of dams and their operation is the most significant factor affecting water quality and aquatic habitats in the Tennessee River and its major tributaries. Portions of several rivers downstream of dams are included on state CWA Section 303(d) lists of impaired waters (TDEC 2020a) due to low DO levels, flow modifications, and thermal modifications as a result of impoundment. TVA has undertaken several major efforts (e.g., TVA's Lake Improvement Plan, Reservoir Release Improvement Plans, and Reservoir Operations Study (TVA 2004)) to mitigate some of these effects on aquatic habitats and organisms. While these actions have resulted in improvements to water quality and habitat conditions in the Tennessee River basin, the Tennessee River and its tributaries remain substantially altered by human activity. Major water quality concerns within

the Tennessee River drainage basin include point and nonpoint sources of pollution that degrade water quality at several locations on mainstream reservoirs and tributary rivers and reservoirs.

Cumberland River Basin

In addition to the Tennessee River basin, the Cumberland River basin drains a significant portion of Middle Tennessee (Figure 3.6-4) and has a total drainage area of over 18,000 square miles (University of Tennessee Press 2021). It is formed by the confluence of Poor and Clover forks in southern Kentucky, loops through middle Tennessee, and joins the Ohio River in western Kentucky (Britannica 2019). The US Army Corps of Engineers has created a series of lakes on the Cumberland River or its major tributaries, including Wolf Creek Dam, Dale Hollow Dam on the Obey River, Center Hill Dam on Caney Fork, Cordell Hull Dam, Old Hickory Dam, Cheatham Dam, and Barkley Dam. The Cumberland River is navigable year-round from Nashville to Smithland, Kentucky (192 river miles) and continues to be used for the transportation of coal, oil, and gravel. Approximately 27,688 miles of streams and rivers flow through the Cumberland River basin (KDOW 2000), with water quality closely related to land use activities. Headwaters of the Cumberland River contain old oil and gas wells, abandoned coal mines, and poorly logged areas, which can contribute to brine, acidity, and silt (respectively). The middle portion of the basin is a mixture of urban, forest, and agriculture, and the lower portion primarily agricultural lands with row crops and livestock, contributing to sedimentation and fecal contamination. Stormwater runoff from urban areas contains automotive oils, sediment, particulates, nutrients, and other urban contaminates.

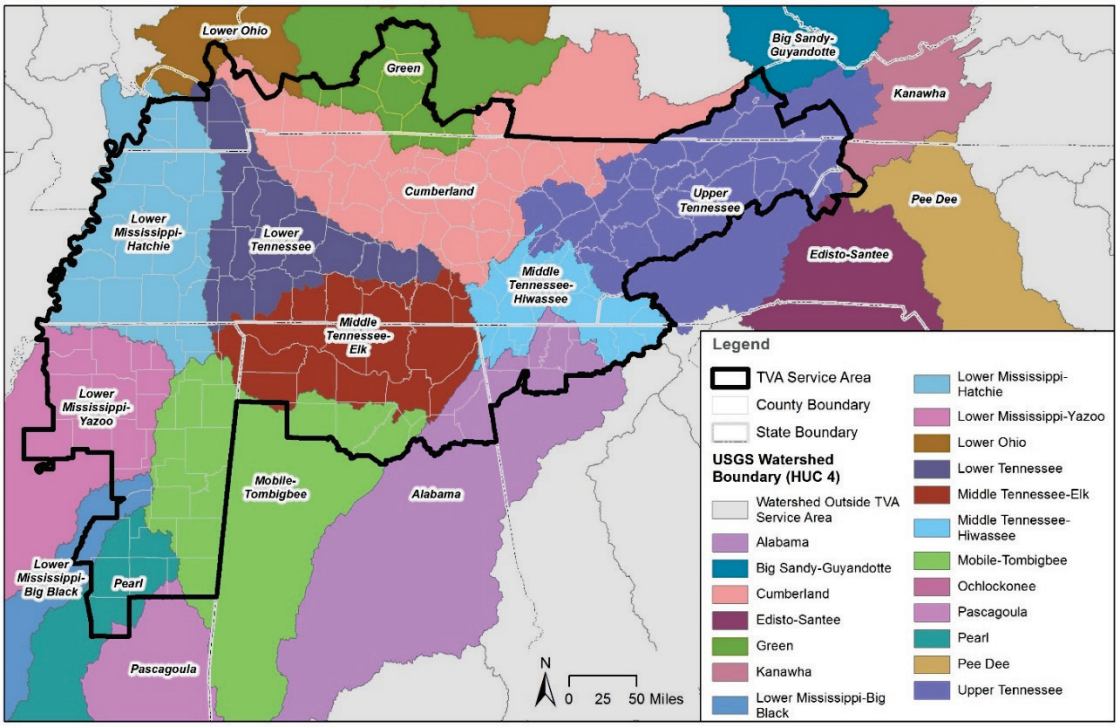

Figure 3.6-4. Major watersheds within TVA region

3.6.2.2. Environmental Consequences

3.6.2.2.1. The No Action Alternative

Under the No Action Alternative, CUF would continue operating and TVA would not construct the proposed new facilities. The existing wastewater streams would continue as authorized under NPDES Permit TN0005789. Discharges would continue to comply with all applicable permit limits, and therefore, surface water quality adjacent to CUF should remain approximately the same. TVA would implement all the planned actions related to the current and future management and storage of CCRs and requirements under the EPA's Steam Electric ELGs at the sites, which have either been reviewed or will be in subsequent NEPA analyses. Continued operations at CUF under the No Action Alternative would not be expected to cause any additional direct or indirect effects to local surface water resources and therefore, would not change existing conditions.

3.6.2.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Under the following action alternatives, CUF would be retired. TVA would implement the planned actions related to the current and future management and storage of CCRs at CUF. Indirect effects may be associated with storm water runoff due to demolition and temporary construction activities. Erosion and sediment control BMPs would be implemented to minimize potential effects.

Under retirement of CUF, current operations would cease and surface water withdrawals would be eliminated. Wastewater discharges would be significantly reduced. The existing wastewater streams would continue to be authorized under NPDES Permit TN0005789. The CCR at the facility would follow requirements detailed in the USEPA Disposal of Coal Combustion Residuals from Electric Utilities final rule (80 FR 21301). The remaining discharge flows would come from fire protection water, main station sumps, storm water flow, and from ponds until closed. Surface water discharges would be expected to have direct and indirect beneficial effects due to the decrease in loading of metals as a result of ceasing operations. The termination of withdrawals and discharges of cooling water would eliminate impingement and entrainment effects and have other beneficial effects from reduced water consumption.

Demolition of the existing fossil plant and construction of the barge unloading dock improvements (which includes removal of existing concrete surface, expanding footprint, and replacing with improved concrete surface) and mooring cells would have the potential to temporarily affect surface water via fugitive emissions, debris, and stormwater runoff. TVA would comply with appropriate state and federal permit requirements. TVA would obtain coverage under the General Construction Storm Water Permit prior to beginning demolition. Surface water effects resulting from disturbance during selective demolition would be mitigated by the use of stormwater pollution prevention BMPs to minimize the extent of disturbance and erosion. Stormwater would discharge via either NPDES permitted discharge points or the designated construction stormwater outfalls. Silt fences, sediment basins, and/or other sediment and erosion control measures, as described in *A Guide for Environmental Protection and Best Management Practices for TVA Construction and Maintenance Activities, Revision 3* (2017a), would be installed, inspected, and maintained for the duration of demolition as needed to avoid contamination of surface water adjacent to the project area. Therefore, no significant effects to surface water would be expected due to surface water runoff from the construction site. Proposed project activities would be conducted in a manner to ensure that waste materials are contained, and the introduction of pollution materials to the receiving waters would be minimized.

Currently active industrial stormwater outfalls are monitored every six months or annually, depending on the NPDES requirements. This monitoring would continue throughout the demolition process, with modifications as directed by the construction BMP plan. Following demolition, permits may be modified or reduced based on the change in operation at the facility. Permit modification requests would be negotiated with TDEC, as necessary, throughout the demolition process.

Stack demolition has the potential to release fugitive dust, fill, and residual ash to adjacent surface water during demolition due to the uncontrolled nature of the dropping of the stack in a single, brief action. This action would result in the generation of fugitive dust and debris, which would then be subject to potential erosion and transport to adjacent surface waters. Following shut-down of the units, stacks would be washed to remove as much ash and dust as possible to reduce potential effects to surface waters during demolition. These demolition activities would be designed in a way to minimize any effects to adjacent waters; however, mitigation measures, such as turbidity curtains in adjacent waters, would be considered to help mitigate any incidental discharge of ash, soil, or sediment to receiving streams. With mitigation measures and BMPs in place, incidental discharges to the Cumberland River due to these activities would be minimized.

Deconstruction of intake/discharge structure facilities (intake and discharge condenser circulating water tunnels [bulkheading] and removal of the intake pump station, fish screens, etc.) and the demolition of the mooring cells has the potential to affect surface waters through conveyance of sediment as part of the removal process. BMPs would be implemented to reduce these potential effects. To conduct this work, USACE and TDEC permits would be required. Anticipated effects to Waters of the State or United States associated with the proposed project would be mitigated with the use of BMPs and implementation of a maintenance program. In the event a permit is required, any mitigation would be identified through the USACE Section 404 and TDEC Section 401 permitting process, providing for compensation for the loss of wetlands or streams as required. Potential surface water effects during demolition would be mitigated, and the effects would be minor with the implementation of BMPs as well as compliance with the requirements of the USACE and TDEC permitting process. Logistical measures for demolition activities would be taken, including portable toilets for the construction workforce with appropriate maintenance measures to avoid contamination of nearby waters and equipment washing and dust control, which would be handled in accordance with BMPs and TVA's NPDES permit.

With the implementation of appropriate BMPs, no significant effects to surrounding surface waters are expected from demolition activities. Cumulative effects to surface water may occur with the proximity of CCR management activities as RFFAs in the CUF Reservation. With the use of proper BMPs and compliance with all federal, state, and local regulations and guidelines, cumulative surface water effects are expected to be temporary and minor.

3.6.2.2.2.1. Environmental Justice Considerations

Effects to surface water due to CUF retirement and D4 activities would be minor and minimized and largely limited to the TVA-owned CUF Reservation, where no populations are present. For effects that may be experienced offsite, these could have an amplified effect on minority/low-income EJ populations given their prominence in the vicinity.

3.6.2.2.3. Alternative A

3.6.2.2.3.1. Construction and Operation of CC Plant at CUF Plant Site

Construction of a CC plant and accompanying features would impact 4 ephemeral channels totaling 1,700 lf (Table 3.6-6) and one isolated pond (0.26 acre). The reaches of ephemeral channels located within the footprints of the CC plant (1 channel, 594 lf), switchyard (2 channels totaling 741 lf), and construction support area (1 channel, 365 lf) would be permanently impacted due to fill.

Table 3.6-6. Potential Impacts to Surface Waters from CC Plant Construction for Alternative A

Action	Feature Type[1]	Type of Impact	No. of Features	Length (lf) or Area (acre)
		CC Plant		
CC Plant	Ephemeral Channel/WWC[2]	Permanent (fill)	1	594 lf
Construction Support	Ephemeral Channel/WWC	Permanent (fill)	1	365 lf
Switchyard	Ephemeral Channel/WWC	Permanent (fill)	2	741 lf
	Isolated Pond	Permanent (fill)	1	0.26 acre
		Total	**4**	**1,700 lf, 0.26 acre**
		Barge Unloading Area Upgrades		
Barge Unloading Area	Perennial Stream (River)	Permanent (fill)	1	250 lf

[1]TDEC in its concurrence that impacts to the wet-weather-conveyances (including ephemeral channels) on CUF can proceed without TDEC/ARAP permitting if proposed activities continue to meet the conditions of Section 69-3-108(q).
[2]In USACE's AJD, approximately 879 lf of ephemeral channel within the CC Plant area and 365 lf of ephemeral channel within the switchyard were determined non-jurisdictional and is not included in the total linear footage.

The proposed CC plant would be air-cooled and would not require cooling water withdrawals from the Cumberland River or other surface waters. Service water would be obtained from potable water sources and not from surface waters on site. Discharges from the operation of the CC Plant, expected to be minor, would require a site-specific NPDES permit and compliance with all applicable regulations and conditions.

An additional 6 ephemeral channels (totaling 2,259 lf) and 2 perennial streams (totaling 362 lf) are within the TL corridor connecting the new CC plant to the existing transmission substation and switchyard; however, none of these streams would be impacted by construction activities. All streams would be spanned by the TLs and structures would not be placed within surface waters.

Upgrades to the barge unloading area would potentially impact up to 250 lf of shoreline along the Cumberland River (Table 3.6-6); however, much if not all of this area already consists of concrete or other unnatural materials. Temporary effects to the Cumberland River would consist of turbidity caused by in-water work for the development of the boat ramp and other activities as described in Section 2.1.3.2.

On August 12, 2022, TVA received concurrence from TDEC that the jurisdictional status of waters within the Alternative A boundary have not changed since the 2017 submittal. Additionally, alterations to the wet-weather-conveyances on site can proceed without

TDEC/ARAP permitting because proposed activities meet the conditions prescribed in Section 69-3-108(q) (Appendix E). On November 4, 2022, an AJD and PJD were received from the USACE for features within Site A2 (USACE 2022b, Appendix E). Portions of two ephemeral channels and a pond that fall within the switchyard and construction support areas were designated as non-jurisdictional based on an AJD. An additional isolated pond that falls within the transmission corridor was also determined non-jurisdictional. The remaining ephemeral channels/WWCs within the disturbance footprint, or ponds within the transmission buffer may be considered jurisdictional per the USACE's PJD. Based on the final jurisdictional determination, TVA would comply with all applicable requirements for regulated actions affecting jurisdictional aquatic features on site. TVA would apply for and adhere to the terms and conditions of all applicable permits and provide required mitigation. Erosion and sediment control BMPs would be implemented as a condition of a NDPES General Construction Storm Water permit.

Cumulative effects to surface water may occur with the proximity of CCR management activities as RFFAs in the CUF Reservation. With the use of proper BMPs, CWA Section 404 and 401 permitting, and compliance with all federal, state, and local regulations and guidelines, cumulative surface water effects are expected to be minor.

3.6.2.2.3.2. Construction and Operation of Natural Gas Pipeline Lateral

Field surveys of the pipeline corridor identified approximately 11,494 lf of surface waters with potential to be directly or indirectly impacted. Construction methods at waterbodies and wetlands would vary according to the physical and environmental characteristics of the crossing location.

An HDD Feasibility Study confirmed that three proposed HDDs are feasible. The three proposed HDDs are for the crossings of Jones Creek (MP 3.2), Wells Creek (MP 30.7), Yellow Creek (MP 22.4), and an unnamed tributary to Yellow Creek for a total of four streams crossed by the three HDDs (TGP 2022b).

According to TGP's Resource Report 2 (TGP 2022b):

> The use of HDDs at these locations would alleviate multiple traditional surface constraints, including the potential for surface resource impact minimization (waterbodies, wetlands, forested areas), and the potential avoidance of multiple surface features including roads, congested construction, and multiple utilities that would occur when using other crossing methods. […] Approximately 0.8 mile of the pipeline would be installed via HDDs that would facilitate the avoidance of direct impacts to 0.26 acre of [surface waters]. The remaining stream crossings required for pipeline installation would be crossed by dry open cut methods, which may include a dry-flumed crossing or a dam and pump depending on site-specific conditions at the time of construction. {Dry open cut crossing methods would be] accomplished by temporarily diverting stream flow around or through the work area to minimize contact between stream water and the excavation and to minimize sediment suspension during trench excavation, pipeline installation, and backfill activities. Typical trench width is 16 inches beyond the width of the pipe. TGP will use HDD and dry open cut methods at any sensitive waterbodies to minimize any potential impact from Project activities. TGP is not proposing the use of wet open cut methods for stream crossings.
>
> TGP would install temporary erosion and sediment control devices along the proposed construction ROW, additional temporary workspaces access roads, and

> contractor yards, as applicable, in accordance with the pipeline project's ECMP, FERC Plan and FERC Procedures (with approved deviations), and any permit specific conditions. The erosion and sediment control devices would be inspected on a weekly basis in areas of active construction and in areas with no construction or equipment operation, and within 24 hours of the end of a storm event that is 0.5 inch of rain or greater. Repairs or maintenance to erosion and sediment control devices would be performed as necessary.

TGP states in Resource Report 1 (TGP 2022a):

> TGP's Draft HDD Contingency Plan is provided in Appendix 1.D.4 and establishes procedures for addressing potential impacts associated with a release of drilling fluid through hydraulically induced fractures during the HDD process. The HDD Contingency Plan will be finalized after the HDD contractor has been selected and TGP will provide updates on the updated plan. The NPS was notified of TGP's plan to use HDD for crossings at Jones Creek, Yellow Creek, and Wells Creek as part of the coordination process for NRI streams and the NPS stated that it does not have any comments or objections to the proposal. TGP would provide on-site inspection during the HDD process to maintain adequate daily progress reports, as-built information, and other applicable construction documentation that would describe the events leading up to an HDD failure. In the event that an attempted HDD installation is unsuccessful, TGP would evaluate the failed installation to determine if the conditions that resulted in the failure can be effectively mitigated. TGP will notify the appropriate regulatory agencies and provide information used to determine whether a second HDD attempt has a reasonable chance to succeed. If it is determined that a second HDD attempt has a reasonable chance of success, TGP would relocate the entry and/or exit point if necessary (subject to any necessary regulatory agency and landowner approvals) and proceed with a second attempt to install the crossing by HDD. If this second HDD attempt fails (or if TGP determines that a second HDD attempt does not have a reasonable chance to succeed), the crossing would be installed by conventional trenching following receipt of applicable permits. In the event that a drilled hole from either a first or second HDD attempt has to be abandoned, the hole will be filled with a mixture of bentonite and drilled spoil.
>
> [TGP would] cross all waterbodies in accordance with the FERC Procedures (with [approved] deviations), the pipeline project's SWPPP, and applicable state and federal regulations and permit conditions. The proposed construction procedures would ensure that potential impacts at all stream crossings are minimized. To limit the amount of time a stream is impacted during construction activities, TGP would clear vegetation on each side of the waterbody, install all sediment barriers, and prepare prefabricated segments of pipeline for installation prior to beginning the stream crossing. Stream crossings would be perpendicular to the flow to the extent practicable. Temporary erosion control measures would be installed as necessary to prevent downstream impacts. If necessary, the pipe used for stream crossings would be weighted to prevent flotation.
>
> Depth of cover in streams would be in accordance with 49 CFR Section 192.327. In consolidated rock, cover would be a minimum of 18 inches in Class 1 areas and 24 inches in Class 2 areas. In normal soils, cover would be a minimum of 30 inches in Class 1 areas and 36 inches in other class areas.

Following construction, streambeds would be restored to their pre-construction elevations and grades. Spoil, debris, piping, construction materials, and any other obstructions resulting from or used during construction of the pipeline would be removed to prevent interference with normal stream flow. Any excavated material not used as backfill would be removed and disposed of in accordance with local, state, and federal conditions. Following grading, all stream banks would be restored to pre-construction conditions and in accordance with permit requirements.

Construction and operation activities that have the potential to impact surface waters include clearing and grading activities; pipeline installation; construction-related discharges (e.g., stormwater and hydrostatic test water); and potential spills or leaks of hazardous liquids from the refueling of construction vehicles or storage of fuel, oil, and other fluids.

[…] TGP anticipates that waterbody impacts from construction-related stormwater runoff, hydrostatic testing of pipelines, and site dewatering would be short-term and localized. TGP is consulting with USACE and TDEC and filed on July 22, 2022 an application for an Individual Permit and Aquatic Resources Alteration Permit [(ARAP)]. Any additional correspondence or communications received from regulatory agencies will be provided to the FERC in CP22-493. The submitted permit application will be reviewed by the USACE Nashville District for compliance with Section 404 of the CWA and Section 10 of the Rivers and Harbors Act. In addition to certificate and permit conditions, all operators and contractors would be required to comply with the FERC Plan and FERC Procedures (with [approved] deviations) and BMPs contained within the ECMP to reduce the risk and severity of potential surface water impacts. The BMPs that would be used to prevent the deterioration of surface water resources during pipeline construction include those listed below.

- All employees and contractors will receive training regarding the handling of oils and hazardous materials commensurate with their position.
- All equipment used in construction and operation will be inspected at regular intervals. All vehicles transporting oils or fuel to construction sites will travel only on approved access routes.
- All equipment at the construction sites will be fueled/maintained at least 100 ft from any waterbody or wetland.
- No hazardous materials, including chemicals, fuels, and oils, will be stored within 100 ft of any waterbody.
- Pumps that transfer hazardous materials and liquids within 100 ft of a waterbody will utilize secondary containment, as appropriate, to prevent spills and overflow.
- Spill response materials will be kept on site and on designated vehicles.

During preparation of the construction workspaces, topographic grading plans will be followed to ensure efficient and environmentally protective storm water drainage. Construction will be designed to direct discharges towards perimeter outfalls through a system of conveyance structures, and if necessary, holding

basins during construction, allowing sufficient retention time to minimize high sediment loads from reaching receiving waters.

Increased turbidity is expected to be limited to the immediate vicinity of construction activities. Sediment will disseminate within the waterbody currents and impacts are anticipated to be relatively minor. […] Once the pipeline is installed, the waterbody banks would be restored to pre-construction conditions to the extent practicable.

ATWS will be required at the proposed HDD entry and exit points. The most significant environmental impacts associated with the HDD construction method relate to the withdrawal of surface water for drilling mud preparation and the potential for the inadvertent release of drilling fluids to the surface along the pipeline alignment during drilling operations. Water for drilling mud preparation would be withdrawn from Jones Creek, Yellow Creek, and Wells Creek. The suction end of the transfer hose would be equipped with a quarter-inch to half-inch screening mesh to minimize the uptake of stones, sticks, and other debris and aquatic biota. The pumping rate would vary from 250 to 500 gpm. Once pumped from the waterbody, the water would be staged in tanks at the drill entry site and used on an as needed basis. The screen mechanisms may require modifications should blockages prevent the withdrawal of water at sufficient rates to support the drilling operations.

In small quantities, the inadvertent release of drilling mud into a waterbody would not adversely affect overall water quality. In large quantities, however, the release of drilling mud could adversely affect water quality and, consequently, resident aquatic life. Drilling mud would primarily consist of non-toxic bentonite, water, and, depending on the drilling conditions, may also contain non-petrochemical-based, non-hazardous additives that meet the National Sanitation Foundation International/American National Standards Institute ("ANSI") Standard 60 for safe drinking water requirements. Containment and disposal of the drilling mud used for HDD would be performed in accordance with applicable permit requirements. TGP's Draft HDD Contingency Plan outlines the procedures that would be used to minimize the potential for an inadvertent release of drilling mud and for effective clean-up should a release occur. Clean-up practices for inadvertent releases include the use of high viscosity bentonite plugs to seal the zone of lost circulation, deployment of straw bales, sandbags, silt fencing, and other containment devices, and the subsequent use of mechanical means (e.g., sump pumps) to remove the drilling mud. If the original drill path cannot be utilized and the drill hole must be abandoned, the hole would be filled with a mixture of bentonite and drilled spoil to prevent the abandoned hole from disrupting groundwater flow.

[…] If dewatering becomes necessary, it would be conducted in a manner consistent with the FERC Procedures (with [approved] deviations). The water would be pumped and discharged in a manner that minimizes erosion and prevents silt-laden water from flowing into any surface waters or wetlands. The dewatering structures would be removed as soon as practicable after the completion of dewatering activities.

The pipeline would be hydrostatically tested for structural integrity prior to being placed in service. Preliminary sources of hydrostatic test water for the proposed

> pipeline are identified in [Table 3.6-7]. Municipal and other private water sources are also being evaluated. TGP would not add any chemicals to the hydrostatic test water […] unless deemed necessary and would obtain [FERC] and other required regulatory approvals to do so. To the extent possible, test water would be cascaded between test sections to minimize the use of water. Where the construction sequence does not allow for cascading water from one section to the next (e.g., where a test needs to be conducted prior to the next section being ready for testing), additional water may be used to fill subsequent test sections. Testing would be completed by capping installed pipe segments with test manifolds, filling these segments with available water, and pressurizing this water to levels beyond the maximum operating pressure of the pipeline. Hydrostatic testing would be conducted in a manner that meets or exceeds the [USDOT] standards in […] 49 CFR Part 192, as outlined in TGP's Draft Hydrostatic Test Plan […]. While other sources of clean water may be used by TGP for hydrostatic testing, currently most of the water withdrawal locations are expected to be from local waterbodies within the construction ROW. Like the water uptake for HDD mud preparation, the pumping rate would vary from 250 to 500 gpm and the water will be passed through a quarter-inch to half-inch mesh screen to minimize the uptake of debris and aquatic biota.

TGP states in Resource Report 2 (TGP 2022b):

> […] Water withdrawals from surface waters will be conducted in accordance with all applicable federal and state permit requirements, and by measures outlined in the FERC Plan and FERC Procedures (with [approved] deviations). […] In addition, water withdrawals will not reduce water to a point that would impair flow and impact wildlife or public and recreational uses.
>
> After pressure testing of the pipeline, the water would undergo water quality analysis to ensure compliance with permits and then be discharged back into upland areas near the point of withdrawal through an energy dissipating structure. Environmental impacts from the discharge of hydrostatic test water would be minimized by the adoption of the measures prescribed in the FERC Plan and FERC Procedures (with approved deviations).

Table 3.6-7. Potential Sources of Hydrostatic Pressure Test Water for the Pipeline

Potential Source(s)	Approximate Milepost	Total Required Water Quantity (gallons)	Manifold/Discharge Location (MP)[1]
Dickson County			
Jones Creek	3.20	3,212,000	3.20
Barton's Creek	10.08	1,696,000	10.08
Furnace Creek	12.14	748,000	12.14
Dry Hollow Branch	14.02	357,000	14.02
Little Barton's Creek	16.65	499,000	16.65
Municipal and/or Private Sources	N/A	Unknown	Unknown

Potential Source(s)	Approximate Milepost	Total Required Water Quantity (gallons)	Manifold/Discharge Location (MP)[1]
Houston County			
Yellow Creek	22.75	3,571,000	22.75
Guices Creek	26.44	915,000	26.44
Municipal and/or Private Sources	N/A	Unknown	Unknown
Stewart County			
Wells Creek	30.68	3,627,000	30.6
Cumberland River (if needed)	N/A	2,000,000	TBD
Municipal and/or Private Sources	N/A	Unknown	Unknown
Total		**6,131,000[2]**	**--**

[1] Water will be discharged to upland areas near the point of withdrawal through an energy dissipating device.
[2] Total water needed. Does not represent column total.

As stated in TGP's Resource Report 2 (TGP 2022b):

> TGP anticipates filing applications with state agencies for hydrostatic test water uptake and discharge following issuance of the FERC Certificate. In accordance with Sections VII.C.2 and VII.D.2 of the FERC Procedures (with [approved] deviations), hydrostatic test water would not be discharged to streams unless approved by the applicable state permitting agency. Should it be determined that additives are necessary based on the source and composition of the test water, TGP would submit detailed information on any chemicals to the Commission for review and approval prior to use.
>
> Operational impacts to surface waters are not anticipated for the [pipeline]. Operational activities that could impact surface waters are restricted to storm water discharges. No withdrawals for industrial or potable use are proposed. Following construction, the pressure regulation station, Cumberland meter station, mainline valves, and proposed permanent access roads will include graveled surfaces, which may result in a potential slight increase in stormwater runoff volumes. TGP would operate the pressure regulation station and Cumberland meter station in accordance with permit conditions and regulatory agencies' rules and regulations to ensure that surface water impacts associated with the [pipeline's] operations are appropriately permitted and mitigated. Water quality impacts associated with stormwater discharges to surface waters are expected to be minor.
>
> During the operation of the pressure regulation station, Cumberland meter station, and MLVs, the potential for a chemical spill that could adversely impact surface waters is low and would be minimized by adherence to TGP's Spill Prevention and Control Plan" (TGP 2022b).

Cumulative effects to surface water may occur given proximity of past/present and RFFAs near the pipeline. Cumulative effects to surface waters would be minimized and mitigated through proper siting of these facilities, the use of BMPs, and adherence to mitigation requirements in applicable CWA Section 404 and 401 permits.

TGP reviewed past, present, and reasonably foreseeable future projects that occur within the same watersheds as the [pipeline] to determine the cumulative impact to surface water resources within the CIAA for water resources. There were four projects identified within the CUF property boundaries that contain approximately 1,437 linear feet of perennial streams and 711 linear feet of intermittent streams (TVA 2016b; 2019b) that may be negatively impacted by project activities. Furthermore, a single freshwater pond was identified on both the Dickson Terminal Project (0.25-acre freshwater pond) and the Economic Development-Canterbury Site (0.24-acre freshwater pond) that may potentially be negatively impacted by these projects (TGP 2022b). The Magnum Manufacturing Expansion has been completed with no reported negative impacts to surface water resources reported on any public forum. The Dickson County Municipal Airport Lighting Upgrades does not require any additional construction to the surrounding area; therefore, no surface water impacts should occur from the activities associated with that project. Finally, positive impacts to surface water resources will occur during the construction and completion of the Hayes Fork Wetland Mitigation Bank and the Cumberland River IFL Program as these are habitat restoration projects, with the Cumberland River ILF Program restoring approximately 3,525 linear feet of intermittent and perennial streams within the watersheds of the proposed pipeline [see TGP's Resource Report 9 (TVA 2022i)].

The planned and existing development projects located in the watersheds crossed by the pipeline corridor have likely received or applied for USACE and TDEC permits and will be required to adhere to similar permit restrictions as the proposed pipeline regarding the minimization of surface water impacts.

As impacts from the [proposed pipeline] on surface waters would be avoided, minimized, or mitigated to the extent practicable no significant incremental contributions to cumulative impacts on surface water resources are anticipated relative to other past, present, or reasonably foreseeable future projects in the area (TGP 2022b).

3.6.2.2.3.3. Summary of Alternative A

Permanent and temporary impacts are likely under the proposed Alternative A (Table 3.6-8). Permanent impacts are primarily due to fill or permanent disturbance to ephemeral channels. Ephemeral channels convey water only during significant rain events. Drainage of this water would be disrupted if these channels are filled; however, appropriate stormwater drainage features or facilities would be constructed as part of the CC plant design. Furthermore, proposed impacts to these features would not be subject to TDEC permitting, per Tennessee Code Section 69-3-108(q). Approximately 250 lf of perennial surface water (Cumberland River) would be permanently impacted due to improvements to the barge unloading area, which will ultimately benefit the public for recreational access.

Temporary effects as summarized below would not result in long-term impacts. Temporary impacts during construction of the natural gas pipeline would result from open cut pipeline

installation, temporary access road crossings, and temporary workspaces. All streams would be returned to their natural, original grade following completion of the pipeline installation and/or Project.

Overall, impacts from Proposed Alternative A would have minor, long-term (permanent) impacts and moderate short-term impacts to surface waters.

Table 3.6-8. Estimated Impacts for Alternative A Proposed CC Plant and Natural Gas Pipeline

Stream Type	CC Plant		Natural Gas Pipeline[1]		Total
	Permanent	Temporary	Permanent	Temporary	
Perennial	250	--	--	2,736	**2,810 lf**
Intermittent	--	--	--	2,677	**2,677 lf**
Ephemeral[2]	2,274	--	--	6,080	**8,354 lf**
Total	**2,524 lf**	**--**	**--**	**11,494 lf**	**14,018 lf**
Ponds	**0.26 acre**	**--**	**--**	**--**	**0.26 acre**

[1]Includes impacts associated with waterbody crossings, access roads, and workspaces.
[2]TDEC in its concurrence that impacts to the wet-weather-conveyances (including ephemeral channels) on CUF can proceed without TDEC/ARAP permitting if proposed activities continue to meet the conditions of Section 69-3-108(q). In USACE's AJD, approximately 1,244 lf of ephemeral channel was determined non-jurisdictional and is not included in the total linear footage.

3.6.2.2.3.4. Environmental Justice Considerations

Effects to surface water due to the CC plant and pipeline would be minor, minimized, or mitigated through CWA 404, 401, and 402 (NPDES) permitting. However, these effects may be amplified on identified low-income and minority qualifying EJ populations since approximately 63 percent of affected streams are within EJ areas. Further, these populations may be more vulnerable to the effects from temporary 404/401 impact activities.

3.6.2.2.4. Alternative B

3.6.2.2.4.1. Construction and Operation of CT Plant at JCT Reservation

No surface waters occur within the proposed JCT site footprint on the Johnsonville Reservation; therefore, no effects to surface waters would occur due to construction of the CT plant (Figure 3.6-3). No surface water withdrawals will be needed for operation of the CT plant; however, the plant would require potable water, which would be obtained from the existing public water supply. During construction, TVA would comply with all appropriate state and federal permit requirements. BMPs would be followed to address construction-related effects, and all proposed project activities would be conducted in a manner to ensure that waste materials are contained, and the introduction of pollution materials to the receiving waters would be minimized. Areas where soil disturbance could occur would be stabilized and vegetated with native or non-native, non-invasive grasses and mulched.

Equipment washing and dust control discharges would be handled in accordance with BMPs required by the site's NPDES permit to minimize construction effects to surface waters. Equipment washing and dust control discharges associated with construction activities would be handled in accordance with BMPs described in the SWPPP for water-only cleaning. Hydrostatic testing for the JCT plant will use available non-potable water and the activity would be covered under the current NPDES Permit.

After construction, storm water BMPs would continue to be implemented so that surface water runoff from parking lots and industrial use areas of the site would be diverted to existing retention pond(s) with a controlled rate(s) of release. Runoff from areas with potential oil leaks, such as distillate-oil storage tanks, would be directed to an oil/water separator with subsequent discharge to a process pond. Oil collected in the oil/water separator would be periodically removed and trucked off site to an approved, waste oil recycling facility.

Restroom facilities to support the workforce at JCT would be properly installed and permitted per local, state, and federal regulatory requirements. Some water treatment may be required to support the operation of the JCT plant. The plant would require potable water, which would be obtained from existing public supply. Up to 130 GPM at JCT would be used for inlet air evaporative cooling in summer ambient temperatures. Potable water for domestic use and safety showers would be obtained from the existing public supply.

Cumulative effects to surface waters at JCT are not anticipated, as the adjacent Aeroderivative CT project would adhere to comparable BMPs.

3.6.2.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

Based on the NHD, construction of a CT plant at Gleason has the potential to directly affect one intermittent stream (1,618 lf) that crosses the CT plant site. During siting of the plant, TVA would avoid and minimize effects to surface waters as practicable. Erosion and sediment control BMPs would be deployed and USACE and TDEC permits would be obtained if effects cannot be avoided.

Similar effects as described for the potential JCT plant would be expected at Gleason, except that up to 100 GPM at Gleason would be needed for inlet air evaporative cooling in summer ambient temperatures. Other BMP descriptions and potable water requirements as described for JCT would also be expected at Gleason. No cumulative effects to surface waters are anticipated with the RFFAs at Gleason.

3.6.2.2.4.3. Transmission and Other Components

The proposed 40-mile transmission line would cross surface waters, including Chestnut Branch, North Fork Obion River, East Fork Clarks River, Holly Fork Creek, Cane Creek, Little Cane Creek, Mayo Branch, and Cypress Creek, and likely other unnamed streams. Based on typical effects for transmission lines as shown in Table 3.3-1, there are an estimated 2.9 stream crossings per mile of new transmission line (with a range of 0 to 50 crossings); for the 40-mile transmission line, this equates to an average of 116 stream crossings (range 0 to 2,000). Standard practice requires that TVA would avoid and minimize effects to surface waters by limiting use of temporary or permanent fill and prioritizing crossing surface waters at a perpendicular angle where practicable. Erosion and sediment control BMPs would be deployed and USACE and TDEC permits would be obtained. Permanent stream crossings for access roads that cannot be avoided would be designed to not impede runoff patterns and the natural movement of aquatic fauna. Temporary stream crossings and other construction and maintenance activities associated with the TLs would comply with appropriate state permit requirements and TVA requirements as described in TVA's BMP manual (TVA 2022a).

3.6.2.2.5. Alternative C

3.6.2.2.5.1. Construction and Operation of Solar and Storage Facilities

Alternative C would result in construction activities that have the potential to permanently affect and/or temporarily affect surface waters via stormwater runoff. As noted in Table 3.2-1, TVA has evaluated typical effects associated with the development of solar facilities. Solar facilities

average approximately 8.7 lf of stream effects per MW, with a range from 0 to 41 lf. Based on the addition of 3,000 MW of solar facilities in Alternative C, an average 26,100 lf of stream would likely be impacted, with up to 123,000 lf of stream effects possible.

TVA and solar developers would minimize effects to surface waters by siting facilities on lands with few surface water resources; configuring the solar arrays, access roads, and other infrastructure to avoid surface waters; and establishing and maintaining buffers around surface waters. BESS sites are typically small enough to be sited to avoid surface water effects. Applicable CWA Section 404 and 401 permits would be obtained from USACE and TDEC and necessary mitigation credits purchased if surface water effects cannot be avoided.

Soil erosion and sedimentation can clog small streams and threaten aquatic life. As noted in the IRP EIS (TVA 2019b), the conversion of a site to a solar facility, with a permanent grass and herbaceous vegetative cover, can reduce the runoff of silt and agricultural chemicals that often occurs from cropland. Appropriate BMPs would be installed, and all proposed project activities would be conducted in a manner to ensure that waste materials are contained, and the introduction of pollution materials to the receiving waters would be minimized. A general construction stormwater permit would be needed for the proposed solar and BESS facilities since more than one acre would be disturbed. This permit requires the development and implementation of a SWPPP, which would identify specific BMPs to address construction-related activities that would be adopted to minimize stormwater effects.

Cumulative effects to surface water may occur under Alternative C with the addition of 10,000 MW of solar identified in the 2019 IRP throughout the TVA PSA. Based on the average of 8.7 lf of effect per MW, this would result in 87,000 lf of additional stream effects within the TVA PSA. Cumulative effects to surface waters would be minimized and mitigated through proper siting of solar facilities, the use of BMPs, and adherence to mitigation requirements in applicable CWA Section 404 and 401 permits.

3.6.2.2.5.2. Transmission and Other Components

As noted in Table 3.3-1, each solar facility results in the construction of an average of 1.7 miles of new transmission line and an average of 2.9 stream crossings per mile of new line. Based on the assumption of thirty 100-MW solar sites, Alternative C would result in approximately 51 miles of new transmission line and 148 surface water crossings. TVA and solar developers would avoid placing structures within surface waters, and effects would be minimized by crossing surface waters at a perpendicular angle where practicable. Erosion and sediment control BMPs would be deployed and USACE and TDEC permits would be obtained. Associated substations and/or switching stations would be sited to avoid surface waters to the maximum extent practicable. With the use of BMPs and adherence to all permit conditions, effects are expected to be minimal.

Cumulative effects to surface water may occur under Alternative C with the addition of 10,000 MW of solar identified in the 2019 IRP throughout the TVA PSA. Transmission lines associated with this expansion would likely result in stream crossings and effects. Cumulative effects to surface waters would be minimized and mitigated through proper siting of transmission lines, the use of BMPs, and adherence to mitigation requirements in applicable CWA Section 404 and 401 permits.

3.6.3. Wetlands

The USACE regulates the discharge of fill material into waters of the United States, including wetlands, pursuant to Section 404 of the CWA (33 USC 1344). Additionally, EO 11990

(Protection of Wetlands) requires federal agencies to avoid, to the extent possible, adverse effects to wetlands and to preserve and enhance their natural and beneficial values. Wetlands are also protected by state regulations (e.g., Tennessee's Aquatic Resources Alteration Permit program). As defined in regulations implementing Section 404 of the CWA (45 FR 85346), wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands and wetland fringe areas can also be found along the edges of many watercourses and impounded waters (both natural and man-made). Wetland habitat provides valuable public benefits, including flood storage, erosion control, water quality improvement, wildlife habitat, and recreation opportunities.

3.6.3.1. Affected Environment

3.6.3.1.1. CUF Reservation

Field reviews were completed in July and August 2021 to determine wetland presence, extent, and condition within the CUF Reservation (TVA 2021e) (Appendix F). Wetland determinations were performed according to the USACE standards, which require documentation of wetland hydrology, hydric soil, and hydrophytic vegetation (USACE 1987; USACE 2012).

Forty-one wetland complexes totaling approximately 173.2 acres were delineated and assessed during the field reconnaissance (TVA 2021e). An additional 95.3 acres of wetlands were estimated through a desktop analysis of areas unable to be reached by the field team during the study (i.e., on islands in the Cumberland River or on the north side of the river). Wetlands are depicted on Figure 3.6-1 and summarized in Table 3.6-9.

The CUF Reservation contains an array of wetland features offering minimal to moderate wetland functions within the surrounding watershed. Wetlands occur on nearly 10 percent of the CUF Reservation and are primarily located within the confluence of the Scott Creek and Wells Creek floodplains. All wetlands on site function in flood storage, stormwater impediment, toxin absorption, and sediment retention. Because the associated reach of Wells Creek has been identified as impaired, the importance of wetland functions and values in the Wells Creek watershed is amplified. Similarly, these wetlands contain a variety of plant communities as indicated by the different wetland types, exhibiting a diversity in species composition that supports a diversity of wildlife.

Table 3.6-9. Summary of Wetlands on the CUF Reservation

Wetland Type	Area (acres)
Delineated Wetlands	
Forested (PFO)	100.9
Emergent (PEM)	29.2
Emergent/Scrub-Shrub/Forested (PEM/PSS/PFO)	18.9
Scrub-Shrub (PSS)	17.5
Emergent/Forested (PEM/PFO)	3.0
Scrub-Shrub/Forested (PSS/PFO)	1.5
Aquatic Bed (PAB)	1.5
Emergent/Scrub-Shrub (PEM/PSS)	0.7
Total	**173.2**
Desktop Analysis	

Wetland Type	Area (acres)
Forested (PFO)	59.15
Emergent/Scrub-Shrub/Forested (PEM/PSS/PFO)	36.15
Total	**95.3**
Grand Total	**268.4**

[1]Designations for each type of wetland follow the classifications developed by the USFWS after Cowardin et al. (1979). PEM = Palustrine Emergent Wetland, PSS= Palustrine Scrub-Shrub Wetland; PFO = Palustrine Forested Wetland; PAB = Palustrine Aquatic Bed

Wetland condition was evaluated using the Tennessee Rapid Assessment Method (TRAM) for wetlands, which quantifies wetland function and classifies wetlands into three categories: low, moderate quality, or exceptional resource value (TVA 2021e). Low quality wetlands are degraded aquatic resources that may exhibit low species diversity, minimal hydrologic input and connectivity, recent or on-going disturbance regimes, and/or predominance of non-native species. These wetlands provide low functionality and are considered low value. Moderate quality wetlands provide functions at a greater value due to a lesser degree of degradation and/or due to their habitat, landscape position, or hydrologic input. Moderate quality wetlands are considered healthy water resources of value. Disturbance to hydrology, substrate, and/or vegetation may be present to a degree at which valuable functional capacity is sustained. Wetlands with exceptional resource value provide high functions and values within a watershed or are of regional/statewide concern. Those wetlands would exhibit little, if any, recent disturbance, provide essential and/or large-scale stormwater storage, sediment retention, and toxin absorption, contain mature vegetation communities, and/or offer habitat to rare species. TRAM wetland conditions for wetlands visited during the field study on the CUF Reservation are summarized in Table 3.6-10.

Table 3.6-10. Delineated Wetland Conditions on the CUF Reservation

Wetland Condition TRAM Category[1]	Acres	Percent
Low Quality	8.27	4.8
Moderate Quality	164.88	95.2
Hight Quality	0	0

[1]TRAM = scores wetland quality by functional capacity

3.6.3.1.2. Alternative A

3.6.3.1.2.1. Proposed CC Plant

The preferred option A2 site for the proposed CC plant is within the boundaries of the CUF Reservation and was reviewed during field investigations in July and August 2021. Of the wetlands delineated, six wetland complexes totaling approximately 29.4 acres fall within the larger boundaries of the option A2 site, with an additional 49.7 acres of wetlands falling within the transmission line corridor (Figure 3.6-1). In a letter dated April 12, 2022, TDEC concurred with the jurisdictional status of the wetlands within the bounds of the proposed CC plant site (and related construction or operational features, such as the transmission line corridors) (Appendix F). On November 4, 2022, an AJD and PJD were received from the USACE for features within Site A2 (USACE 2022b, Appendix E). Wetlands falling within the transmission corridor are considered potentially jurisdictional based on the USACE's PJD decision, and one wetland within the greater A2 site boundary (0.39 acre) was considered non-jurisdictional based on the AJD. Wetland habitat types are presented in Table 3.6-11 and Table 3.6-12.

Table 3.6-11. Summary of Wetlands on the A2 Site

Wetland Habitat Type	A2 Site (acres)	Transmission Corridor (acres)
Emergent (PEM)	3.58	10.2
Emergent/Forested (PEM/PFO)	--	0.68
Emergent/Scrub-Shrub/Forested (PEM/PSS/PFO)	18.8	--
Forested (PFO)	3.43	30.5
Scrub-Shrub (PSS)	3.55	6.89
Scrub-Shrub/Forested (PSS/PFO)	--	1.42
Total	**29.4**	**49.7**

[1]Designations for each type of wetland follow the classifications developed by the USFWS after Cowardin et al. (1979). PEM = Palustrine Emergent Wetland, PSS= Palustrine Scrub-Shrub Wetland; PFO = Palustrine Forested Wetland.

Table 3.6-12. Delineated Wetland Conditions on the A2 Site

Wetland Condition TRAM Category[1]	A2 Site (acres)	Transmission Corridor (acres)
Low Quality	0.39	1.15
Moderate Quality	29.08	48.6
High Quality	0.0	0.0

[1]TRAM = scores wetland quality by functional capacity

3.6.3.1.2.2. Natural Gas Pipeline Corridor

Field surveys were conducted from June 2021 to January 2022 to identify wetlands within the pipeline corridor. Wetlands were surveyed in accordance with the methodology outlined in the USACE Wetlands Delineation Manual and The Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (USACE 2012). Field surveys included all construction workspaces where landowner access had been granted. Two classes (Cowardin et al. 1979) of palustrine (freshwater) wetland systems are present along the natural gas pipeline corridor: palustrine forested (PFO) and palustrine emergent (PEM). Wetlands identified in the pipeline corridor are summarized in Table 3.6-13 and depicted on figures in Appendix G.

Table 3.6-13. Wetlands Identified within the Natural Gas Pipeline Corridor

Wetland Habitat Type	County	Additional Temporary Workspace (acres)	Access Roads (acres)	Temporary Workspace for Construction (acres)	New Permanent Easement/ Operations (acres)
Forested (PFO)	Dickson	0.00	0.00	0.01	0.02
	Houston	0.00	0.00	<0.01	0.00
Emergent (PEM)	Dickson	0.00	0.00	0.03	<0.01
	Houston	0.00	0.01	0.09	0.00
	Stewart	0.02	0.00	0.04	0.05
Total		**0.02**	**0.01**	**0.17**	**0.07**

[1]Designations for each type of wetland follow the classifications developed by the USFWS after Cowardin et al. (1979). PEM = Palustrine Emergent Wetland, PFO = Palustrine Forested Wetland.
[2]Total workspace includes temporary workspace for construction, access roads, and new permanent easement/operations.

3.6.3.1.3. Alternative B

3.6.3.1.3.1. Johnsonville Reservation

The Johnsonville Reservation is located on the east bank of the Kentucky Reservoir of the Tennessee River. The proposed JCT would be located on previously developed portions of the Johnsonville Reservation which do not contain wetlands.

3.6.3.1.3.2. Gleason Reservation

A desktop review of the NWI data suggests no wetlands exist on the proposed CT plant site.

3.6.3.1.3.3. Transmission Corridors

The proposed 40-mile transmission line would cross surface waters, including Chestnut Branch, North Fork Obion River, East Fork Clarks River, Holly Fork Creek, Cane Creek, Little Cane Creek, Mayo Branch, and Cypress Creek, that likely contain associated wetlands. As noted in Table 3.3-1, transmission lines typically result in an average of 0.9 acre (range of 0 to 22.2 acres) of wetland effects per mile of new line. The proposed 40-mile transmission line could contain approximately 36 acres (range of 0 to 888 acres) of wetlands.

3.6.3.1.4. Alternative C

3.6.3.1.4.1. Middle Tennessee TVA Power Service Area

Wetlands occur across the TVA region and are most extensive in the south and west where they comprise 5 percent or more of the landscape (USGS 2016). Wetlands in the TVA region consist of two main systems: (1) palustrine wetlands such as marshes, swamps, and bottomland forests dominated by trees, shrubs, and persistent emergent vegetation, and (2) lacustrine wetlands associated with lakes, such as aquatic bed wetlands (Cowardin et al. 1979). Riverine wetlands associated with moving water within a stream channel are also present but are relatively uncommon. Almost 200,000 acres of wetlands are associated with the TVA reservoir system, where they are more prevalent on mainstem reservoirs and tailwaters than tributary reservoirs and tailwaters (TVA 2004). Almost half of this area is forested wetlands; other types include aquatic beds and flats, ponds, scrub/shrub wetlands, and emergent wetlands.

3.6.3.2. Environmental Consequences

3.6.3.2.1. The No Action Alternative

Under the No Action Alternative, TVA would continue current plant operations until the scheduled retirement, and no work would be conducted that would result in a change to existing conditions. Therefore, there would be no direct or indirect effects to wetlands because there would be no physical changes to the current conditions.

3.6.3.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Under the following action alternatives, CUF would be retired and ultimately deconstructed. No direct, indirect, or cumulative effects to wetlands are expected since no wetlands are currently present within the existing plant footprint.

3.6.3.2.3. Alternative A

3.6.3.2.3.1. Construction and Operation of CC Plant at CUF

Approximately 29.4 acres of wetlands are present within the proposed CC project site (Table 3.6-14). The disturbance footprint would avoid impacts to all wetlands on the site except for two forested wetlands totaling of 2.1 acres. These wetlands would be impacted by conversion of wetland type for the construction and operation of the TLs connecting the new CC

plant to the existing transmission substation and switchyard. Trees would be cleared from the wetlands to assure the safe and reliable operation of the transmission facilities resulting in the permanent conversion of the wetlands to scrub-shrub or emergent wetlands. Stumps, root wads, and root systems of trees in wetland areas cleared for the transmission line would be left in place. No new TL structures are proposed within wetlands.

Table 3.6-14. Total On-site Wetlands and Total Wetland Acreage Potentially Impacted by the CC Plant Construction

Wetland Type	Cowardin Classification	Impact Type	No. of Wetland Areas	Total Area (acres)
Forested	PFO1C	Permanent (conversion)	1	1.74
Forested	PFO1E	Permanent (conversion)	2	0.32

On August 12, 2022, TVA received concurrence from TDEC that the jurisdictions of waters within the Alternative A boundary have not changed since the 2017 submittal (Appendix E). On October 21, 2022, TGP received concurrence from TDEC. On November 4, 2022, an AJD and PJD were received from the USACE for features within Site A2 (USACE 2022b, Appendix E). Wetlands falling within the transmission corridor are considered potentially jurisdictional based on the USACE's PJD decision, and one wetland within the greater A2 site boundary (0.39 acre) was considered non-jurisdictional based on the AJD. If it is determined, through ongoing consultation with the agencies, that unavoidable impacts to wetlands or waterbodies are anticipated, applicable CWA Section 404 and 401 permits would be obtained from USACE and TDEC and mitigation credits would be purchased. Erosion and sediment control BMPs would be used to minimize indirect effects to wetlands (TVA 2022a).

Cumulative effects to wetlands may occur with the proximity of CCR management activities as RFFAs in the CUF Reservation. With the use of proper BMPs, CWA Section 404 and 401 permitting, and compliance with all federal, state, and local regulations and guidelines, cumulative wetland effects are expected to be minor.

3.6.3.2.3.2. Construction and Operation of Natural Gas Pipeline

TGP received an HD for waters within the pipeline corridor from TDEC on October 21, 2022. As stated in TGP's Resource Report 2 (TGP 2022b):

> Construction of the […] pipeline facilities will temporarily impact a total of 0.27 acre of wetlands. No permanent filling or loss of wetlands is proposed for the [pipeline]. However, the [pipeline]will result in the permanent conversion of 0.02 acre of forested wetlands within the new permanent easement to an herbaceous wetland type due to construction clearing and periodic maintenance activities in accordance with the FERC Procedures (with requested modifications). In addition, 0.01 acre of forested wetland in the temporary workspace will be cleared during construction but allowed to eventually revegetate back to its forested state following restoration efforts, also in accordance with the FERC Procedures (with requested modifications). Further, no indirect impacts to any downgradient wetlands from construction activities are expected through placement of erosion controls and other measures outlined in the [pipeline] ECMP, which incorporates the FERC Plan and FERC Procedures (with requested deviations).
>
> Temporary wetland impacts may include soil disturbance, temporary alteration of hydrology, and loss of vegetation during construction. Following construction, all

wetlands will be restored to their pre-construction grades, contours, and drainage patterns, and reseeded or replanted with native hydrophytic vegetation species. Trench plugs may be installed to prevent unwarranted drainage within these wetlands until pre-construction conditions have been restored. As outlined in the FERC Procedures (with requested deviations), as part of the permanent ROW, a 10-foot-wide area centered over the pipeline will be continuously mowed and maintained in an herbaceous/scrub-shrub state to allow for inspection and maintenance of the pipeline once it is in service. In addition, trees within 15 ft of the pipeline with roots that could compromise the integrity of the pipeline coating will be selectively cut and removed from the permanent ROW.

TGP will use the standard and conventional wetland construction methods for pipeline construction in wetland areas. The construction ROW width at any specific location will depend directly on the construction method adopted, which is primarily determined by water depth and vegetative cover. The standard wetland construction method will be utilized in wetlands where soils are not saturated and able to support construction equipment at the time of crossing. The conventional wetland construction method will be utilized in wetlands where the standard wetland construction method is not feasible.

TGP will ensure that construction impacts are appropriately addressed through adherence to permit conditions and implementation of the protective measures in the FERC Plan and FERC Procedures (with requested deviations), and the [pipeline]-specific HDD Contingency Plan, Blasting Plan, and Hydrostatic Test Plan (Appendices 1.D.4, 1.D.6, and 1.D.8 of *Resource Report 1 - Project Description)*. For wetlands, these protective measures are embodied in the use of the standard and conventional wetland construction methods and include:

- Minimizing vegetation clearing and soil disturbance;
- Avoiding unnecessary vehicular traffic and equipment use;
- Installing and maintaining erosion and sedimentation control devices such as straw bales and silt fences;
- Restricting the duration of construction to the extent practicable;
- Using timber construction mats to create a temporary work surface in wet conditions; and
- Using low pressure ground equipment in wet conditions to minimize vegetation damage, soil compaction, and rutting.

Areas of construction-related temporary impacts will be restored to pre-construction conditions and allowed to revegetate naturally. Restoration of the temporarily impacted areas will be monitored and the successful achievement of pre-construction conditions will be determined after one full growing season post-construction. For locations where pre-construction conditions are not achieved after one full growing season, TGP will continue to monitor wetlands until restoration is achieved and work with the USACE and TDEC to determine the appropriate follow-up measures if needed.

The permanent easement of the pipeline will be maintained by routine vegetation mowing and clearing maintenance activities in accordance with the FERC Plan and FERC Procedures (with requested deviations). No wetlands are located within the Pressure Regulation Station, MLVs, or the Cumberland Meter Station; therefore, there will be no operation impacts associated with the long-term operation of these facilities.

TGP will develop a wetland mitigation plan specific to the Project in coordination with applicable federal and state agencies. As of the date of this resource report, TGP is not proposing compensatory mitigation for the temporary impacts to PEM wetland systems. TGP will discuss with the USACE and TDEC the need for compensatory mitigation for the temporary and permanent loss of 0.03 acre of forested canopy due to Project construction and periodic maintenance activities [Table 3.6-15 below]. Wetlands temporarily impacted by construction activities will be allowed to revegetate naturally. TGP does not intend to re-seed or re-plant any of the wetlands affected by the Project. TGP plans to rely on natural revegetation to occur in these wetlands and will monitor according to the FERC Procedures (with requested modifications). TGP will adhere to the USACE permit conditions pertaining to seeding and replanting (if included if the USACE permit issued for the Project).

Annual monitoring in accordance with the FERC Procedures (with requested deviations), and any USACE and TDEC permit conditions, will be conducted to ensure wetlands are properly restored to pre-construction conditions. TGP proposes to offset the loss of 0.03 acre of forested wetland canopy in cooperation with the USACE if deemed necessary. During the permitting process, TGP will coordinate with the USACE and TDEC to determine whether any mitigation of Project impacts is necessary, and if so, the form of mitigation.

Table 3.6-15. Compensatory Mitigation Summary for Wetlands Impacted due to the Alternative A Natural Gas Pipeline Corridor

Cowardin Classification	Temporary Conversion (acres)	Permanent Conversion (acres)	Total (acres)
PFO	0.01	0.02	0.03
Total	**0.01**	**0.02**	**0.03**

Cumulative effects to wetlands may occur due to past/present and RFFAs in proximity to the pipeline. Cumulative effects to wetlands would be minimized and mitigated through proper siting of these facilities, the use of BMPs, and adherence to mitigation requirements in applicable CWA Section 404 and 401 permits.

The cumulative impact analysis for pipeline-related impacts to water resources was defined as HUC 12 watersheds crossed by the [pipeline]. These include Lower Jones Creek (51302040503), Outlet Harpeth River (51302040606), Trace Creek-Harpeth River (51302040605), Furnace Creek (51302050101), Upper Bartons Creek (51302050102), Lower Bartons Creek (51302050104), Lower Yellow Creek (51302050203), Outlet Yellow Creek (51302050205), Johnson Creek-Cumberland River (51302050302), Guices Creek (51302050401), and Wells Creek (51302050402). The following projects were identified as past, present, or

reasonably foreseeable future projects located within the watersheds that are crossed by the proposed [pipeline] and were considered for this evaluation:

- TVA Cumberland Fossil Plant Retirement;
- Management of Coal Combustion Residuals from the Cumberland Fossil Plant;
- Cumberland Fossil Plant Borrow Areas and Access Road;
- Cumberland Fossil Plant Wastewater Treatment Facility;
- Cumberland River Compact in Lieu-Fee Program Instrument;
- Dickson Terminal Project;
- Economic Development-Canterbury Site;
- Dickson County Municipal Airport Lighting Upgrade;
- Magnum Manufacturing Expansion; and
- Hayes Fork Wetland Mitigation Bank" (TGP 2022b).

[…] Four projects that may negatively impact wetland resources were identified within the CUF property boundaries containing approximately 0.51 acre of wetlands (TVA 2016b, 2019b). No wetlands were identified on the properties for the Dickson Terminal Project and the Economic Development-Canterbury Site Project. Furthermore, the Magnum Manufacturing Expansion Project was completed with no documented impacts to wetland resources reported on any public forum. The Dickson County Municipal Airport Lighting Upgrades Project required no additional construction to the surrounding area, and therefore should not negatively impact wetland resources. Finally, positive impacts to wetland resources will occur during the construction and completion of the Hayes Fork Wetland Mitigation Bank and the Cumberland River ILF Program Instrument as these are habitat restoration projects, with the Hayes Fork Wetland Mitigation Bank restoring approximately 19.6 acres of wetlands within the watersheds of the pipeline area.

3.6.3.2.3.3. Summary of Alternative A

Permanent and temporary effects to wetlands are proposed for Alternative A (Table 3.6-16). Permanent impacts related to the transmission line corridors would result from the conversion of forested wetland habitat to emergent or shrub-scrub habitat. While this does not eliminate wetland habitat, some wetland function would be altered due to the long-term change in the vegetation community.

The permanent effect for the natural gas pipeline is related to a new permanent easement for the operation of the pipeline. Like the permanent impact for the transmission line corridor, this would result in a permanent conversion in wetland habitat type.

Temporary effects from construction of the natural gas pipeline would also occur due to temporary workspaces and access roads needed for construction.

Overall, wetland effects for Alternative A are moderate and long-term.

Table 3.6-16. Estimated Wetland Effects for Associated Transmission Line Impacts from Alternative A and the Natural Gas Pipeline

Stream Type	Transmission Line		Natural Gas Pipeline		Total
	Permanent	Temporary	Permanent	Temporary	
Emergent (PEM)	--	--	0.05	0.19	**0.24**
Shrub-Scrub (PSS)	--	--	--	--	**0.0**
Forested (PFO)	2.06	--	0.02	0.01	**2.09**
Total	**2.06**	**0.0**	**0.07**	**0.20**	**2.33**

[1]Designations for each type of wetland follow the classifications developed by the USFWS after Cowardin et al. (1979). PEM = Palustrine Emergent Wetland, PSS= Palustrine Scrub-Shrub Wetland; PFO = Palustrine Forested Wetland.

3.6.3.2.3.4. Environmental Justice Considerations

Effects to wetlands due to the CC plant and the pipeline would be minor, minimized, or mitigated through CWA 404, 401, and 402 (NPDES) permitting. For the CC plant, these would be largely limited to the TVA-owned CUF Reservation, where no populations are present. Effects that may be experienced offsite could have an amplified effect on low income and minority qualifying EJ populations given their prominence in the vicinity. For the pipeline, approximately 34 percent of affected wetlands are within EJ areas; thus, effects to wetlands may be experienced more prominently by non-EJ populations.

3.6.3.2.4. Alternative B

3.6.3.2.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Based on desktop survey, construction of the JCT on the Johnsonville Reservation would not affect wetlands because there are likely no wetlands located within the proposed plant site. No cumulative effects to wetlands would occur.

3.6.3.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

A desktop review of the NWI did not identify the presence of wetlands on the Gleason Reservation and therefore, wetland effects are not likely to result from construction and operation of the plant and no cumulative effects to wetlands would occur. However, should this alternative be selected, a wetland assessment would be performed at Gleason and project-related effects to wetlands (if identified) would be avoided, mitigated, and/or permitted as required prior to commencement of construction activities.

3.6.3.2.4.3. Transmission and Other Components

Based on a desktop survey, construction of the 40-mile TL would result in direct and indirect effects to wetlands. As noted in Table 3.3-1, transmission lines typically result in an average of 0.9 acres of wetland effects per mile of new line, which is approximately 36 acres for a 40-mile line. TVA would avoid placing structures within wetlands where practicable. The transmission line may require clearing of forested wetlands, which would convert forested systems to emergent, maintained wetlands. Access across wetlands located in the ROW would be conducted in accordance with wetland BMPs to minimize soil compaction and ensure only temporary effects result (TVA 2022a). This includes use of low ground pressure equipment, wetland mats, and dry season work scheduling. Erosion and sediment control BMPs would be deployed and USACE and TDEC permits would be obtained and necessary mitigation credits purchased.

3.6.3.2.5. Alternative C

3.6.3.2.5.1. Construction and Operation of Solar and Storage Facilities

As noted in Table 3.2-1, TVA has evaluated typical effects associated with the development of solar facilities. Solar facilities average approximately 0.003 acre of wetland effects per MW of installed capacity, with a range of 0 to 0.1 acre. Solar facilities average approximately 0.01 acre of conversion effects per MW from the clearing of forested wetlands, with a range of 0 to 0.1 acres.

Construction of 3,000 MW of solar facilities would average 9 acres and up to 300 acres of wetland effects, in addition to an average of 30 acres and up to 300 acres of habitat conversion from clearing forested wetlands. Impacts to wetlands would be spreads across approximately 30 solar sites in the Middle Tennessee region, assuming each site is 100 MW. TVA and solar developers would minimize effects to wetlands by siting facilities on land with few wetland resources; configuring the solar arrays, access roads, and other infrastructure to avoid wetlands; and establishing and maintaining buffers around wetlands. BESS sites are typically small enough to be sited to avoid wetland effects. Appropriate BMPs would be installed, and all proposed project activities would be conducted in a manner to ensure that waste materials are contained, and the introduction of pollution materials to wetlands would be minimized.

Cumulative effects to wetlands may occur under Alternative C with the addition of 10,000 MW of solar identified in the 2019 IRP throughout the TVA PSA. Based on the average of 0.003 acres of effect per MW, this would result in 30 acres of additional wetland effects within the TVA PSA. Cumulative effects to wetlands would be minimized and mitigated through proper siting of solar facilities, the use of BMPs, and adherence to mitigation requirements in applicable CWA Section 404 and 401 permits.

3.6.3.2.5.2. Transmission and Other Components

As noted in Table 3.3-1, transmission lines typically result in an average of 0.9 acres of wetland effects per mile of new line. Based on TVA's evaluation, approximately 1.7 miles of new transmission line are needed for solar facilities, which indicates that approximately 1.5 acres of wetlands may be impacted for each facility. TVA would avoid placing structures within wetlands where practicable. The transmission line may require clearing of forested wetlands, which would convert forested systems to emergent, maintained wetlands. Access across wetlands located in the ROW would be conducted in accordance with wetland BMPs to minimize soil compaction and ensure only temporary effects result (TVA 2022a). This includes use of low ground pressure equipment, wetland mats, and dry season work scheduling. Erosion and sediment control BMPs would be deployed and USACE and TDEC permits would be obtained and necessary mitigation credits purchased.

Cumulative effects to wetlands may occur under Alternative C with the addition of 10,000 MW of solar identified in the 2019 IRP throughout the TVA PSA. Transmission lines associated with this expansion would likely result in wetland crossings and conversion of forested wetlands to maintained wetlands. Cumulative effects to wetlands would be minimized and mitigated through proper siting of transmission lines, the use of BMPs, and adherence to mitigation requirements in applicable CWA Section 404 and 401 permits.

3.7. Air Quality and Greenhouse Gases/Climate Change

Air pollution is defined as the presence in the outdoor atmosphere of one or more air contaminants in sufficient quantities and of such characteristics and duration as to be injurious to human, plant, or animal life, or to property, or which unreasonably interfere with the enjoyment of life and property [Rules of TDEC, Division of Air Pollution Control, Chapter 1200-

03-02-.01(d)]. Air quality, as a resource, incorporates several components that describe the levels of overall air pollution within a region, sources of air emissions, and regulations governing air emissions. The National Ambient Air Quality Standards (NAAQS), state-level ambient air quality standards, local ambient air quality, and the air quality requirements for stationary sources in the areas affected by the alternative actions are discussed further below.

The global climate system changes in time under the influence of its own internal dynamics and because of external forcings, such as volcanic eruptions; solar variations; orbital forcing; and human-generated, *i.e.*, anthropogenic, forcings, such as the changing composition of the atmosphere and land-use change. Greenhouse gases (GHG) in the atmosphere,[8] primarily carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and other fluorine-containing compounds, absorb heat that is radiated from the Earth's surface. Anthropogenic increases in atmospheric concentrations of GHG are considered the main driver for warming of the Earth's atmosphere over the industrial era by trapping more heat, resulting in what is referred to as global warming, which is considered to result in climate change. The majority of anthropogenic GHG emissions, primarily in the form of CO_2, result from the combustion of fossil fuels in both stationary sources (e.g., power plants, industrial facilities, boilers) and mobile sources (e.g., on-road and off-road motor vehicles and construction equipment, rail, and marine transportation). Additional anthropogenic sources of GHG emissions that contribute to climate change include methane and nitrous oxide from agricultural sources; hydrofluorocarbons used in refrigerant equipment; and sulfur hexafluoride used as a gaseous dielectric medium for high-voltage circuit breakers, switchgears, and other electrical equipment. Emissions of hydrofluorocarbons and sulfur hexafluoride would be from equipment seal leaks, particularly from older equipment, as well as during manufacturing, installation, servicing, and disposal. However, relative to combustion-related GHG emissions, such leaks are minimal within the TVA system.

General TVA-wide information regarding GHG emissions and the climate conditions in the TVA region are described further below in the Affected Environment section. In addition, alternative-specific GHG emissions are also described further below.

3.7.1. Affected Environment

3.7.1.1. Air Quality and Associated Laws/Regulations

The CAA of 1970, as amended in 1977 and 1990, is the comprehensive law that forms the basis of regulating emissions of air pollutants from stationary sources (such as power plants and industrial plants) and mobile sources (such as motor vehicles, locomotives, marine vessels). It requires USEPA to establish and update NAAQS for ubiquitous air pollutants and directs states to develop State Implementation Plans to achieve these standards. This is accomplished through air quality construction and operating permitting programs that establish emissions limits, installation of emissions control technologies, and work practice requirements applicable to various sources. The CAA also requires USEPA to set standards for emissions of specific hazardous air pollutants (HAPs).

The study area for air quality is defined as the counties where the proposed facilities are located. While power plant air emissions disperse across county and state lines and contribute to effects in areas downwind, these long-distance effects from any one facility or set of facilities, such as those assessed in this document, are expected to be minimal because individual facility emissions are a very small fraction of the statewide or regionwide emissions that contribute to downwind air quality effects. Under the mandates of the CAA, EPA programs to reduce large-

[8] *See* 42 U.S.C. § 7545(o)(1)(G) (defining GHG to include carbon dioxide, hydrofluorocarbons, methane, nitrous oxide, perfluorocarbons, sulfur hexafluoride).

scale effects have included nationwide programs, including New Source Performance Standards (NSPS); Acid Rain rules; Interstate Air Pollution Transport rules; several programs to reduce fleetwide emissions of onroad and nonroad engines; and other rules. Thus, for the proposed action and alternatives, the air quality study areas are set at the county scale. The study area for GHG emissions is effectively the global atmosphere.

3.7.1.1.1. Ambient Air Quality Standards

Air quality is measured primarily by the concentrations of six criteria pollutants within a region. Those six criteria air pollutants are subject to NAAQS that were developed by the USEPA Office of Air Quality Planning and Standards and were chosen because they are the predominant air pollutants of concern for the environment and public health. The criteria pollutants are ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), lead (Pb), sulfur dioxide (SO_2), and particulate matter (PM), which includes two subcategories: particles less than 10 microns in diameter (PM_{10}) and particles less than 2.5 microns in diameter ($PM_{2.5}$).[9] The NAAQS are summarized in Table 3.7-1. States and U.S. territories with delegated authority for regulating air quality have the option to impose stricter ambient air quality standards than the NAAQS. The Tennessee Ambient Air Quality Standards (TN AAQS) are included in Table 3.7-1 where they differ from the NAAQS.

USEPA designates compliance status for the NAAQS through a formal rulemaking process involving publication of proposed and final rules in the *Federal Register*. For each pollutant for which there is a NAAQS, USEPA designates an area as attainment, nonattainment, or maintenance. An attainment area meets the NAAQS. A nonattainment area does not meet the NAAQS but has a state implementation plan for establishing requirements to restrict emissions to achieve attainment status. A maintenance area (or maintenance/attainment area) is one that was designated as nonattainment within the prior 20 years and has come into attainment with the NAAQS. Part of the redesignation process requires that the state or local agency with responsibility for managing air quality in the area must submit for USEPA approval a plan to maintain compliance with the NAAQS for which the area was in nonattainment status. After the 20-year maintenance period ends and compliance is still maintained, this area defaults to “normal” attainment area status. Strategies remain after the 20-year period to maintain compliance unless the delegated regulatory agency demonstrates to the USEPA that such measures are no longer needed.

Table 3.7-1. National and Tennessee Ambient Air Quality Standards

Pollutant	Averaging Times	Primary NAAQS and TN AAQS	Secondary NAAQS and TN AAQS
CO	8-hour [(a)]	9 ppm (10 mg/m^3)	None; TN – Same as Primary
	1-hour [(a)]	35 ppm (40 mg/m^3)	None; TN – Same as Primary
Pb	Rolling 3-Month Average	0.15 µg/ m^3; TN - None	Same as Primary; TN - None
	Quarterly Average	1.5 µg/ m^3	Same as Primary
NO_2	Annual (Arithmetic Mean)	0.053 ppm (100 µg/m^3)	Same as Primary

[9] Ozone is not directly emitted from the emissions sources in this Proposed Action, but it is formed in the lower atmosphere through photochemical reactions between direct emissions of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) and sunlight.

Pollutant	Averaging Times	Primary NAAQS and TN AAQS	Secondary NAAQS and TN AAQS
	1-hour [f]	0.100 ppm (188 ug/m^3); TN - None	None; TN- None
PM_{10}	24-hour (b)	150 µg/m3	Same as Primary
	Annual (Arithmetic Mean)	None; TN – 50 µg/m3	None; TN – Same as Primary
$PM_{2.5}$	Annual [c] (Arithmetic Mean)	12.0 µg/m^3; TN - None	15.0 µg/m^3; TN - None
	24-hour [d]	35 µg/m^3; TN - None	Same as Primary; TN - None
O_3	8-hour [e]	0.075 ppm (2008 std.)	Same as Primary
	8-hour [e]	0.070 ppm (2015 std.)	Same as Primary
	1-hour	None; TN – 0.12 ppm	None; TN – 0.12 ppm
SO_2	3-hour [a]	none	0.5 ppm (1300 µg/m^3)
	1-hour [g]	0.075 ppm (196 ug/m^3)	Same as Primary

Sources: 40 CFR part 50, USEPA 2021a; Chapter 1200-3-3-.03, https://publications.tnsosfiles.com/rules/1200/1200-03/1200-03.htm (TDEC 2021b).

a Not to be exceeded more than once per year.

b Not to be exceeded more than once per year on average over 3 years.

c To attain these standards, the 3-year average at any monitor must not exceed 12.0 µg/m^3 for the primary standard and 15.0 µg/m^3 for the secondary standard.

d To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3.

e To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average O_3 concentrations measured at each monitor within an area over each year must not exceed the standard. While both the 2008 and 2015 standards are still in place, the 2015 standard is the controlling one, given its greater stringency.

f Standard is attained when the 3-year average of the eighth-highest daily maximum 1-hour average NO_2 concentration does not exceed 0.100 parts per million (ppm) or 100 parts per billion (ppb).

g Standard is attained when the 3-year average of the fourth-highest daily maximum 1-hour average SO_2 concentration does not exceed 0.075 ppm (196 ppb).

3.7.1.1.2. Hazardous Air Pollutants

Other air pollutants that have caused concern due to their harmful health or environmental effects and known or suspected potential for causing cancer include HAPs. The CAA identifies 187 pollutants as HAPs, some of which are emitted from power plants. The most notable HAPs regarding coal and oil-fired plants include heavy metals such as mercury, cadmium, lead, and arsenic, and hydrogen chloride, hydrogen fluoride, and various hydrocarbons. The emissions of most HAPs from coal-fired power plants are much greater than from natural gas-fired power plants, on a pounds per million British Thermal Unit (lb/MMBtu) of fuel basis, due to higher concentrations of pollutant-forming compounds in coal.

The USEPA has singled-out mercury as a special pollutant of concern regarding oil and coal-fired power plants. In 2011, the USEPA promulgated the Mercury and Air Toxics Standards (MATS) [Title 40, CFR, Part 63, Subpart UUUUU] to reduce mercury and other toxic air pollutants from such plants. TVA has significantly reduced mercury emissions since 2000 due to the retirement and replacement of some coal-fired units with other sources of generation and the installation of emissions controls (e.g., flue gas desulfurization, selective catalytic reduction, and activated carbon injection systems) on most remaining coal-fired units.

The USEPA has also promulgated National Emissions Standard for Hazardous Air Pollutants (NESHAP) for Stationary Combustion Turbines under 40 CFR 63, Subpart YYYY, that are major sources of HAPs, defined as sources having the potential to emit 10 tons per year (tpy) of any individual HAP or 25 tpy or more of any combination of HAPs. Generally, the requirements include emissions limitations for formaldehyde and operational limitations including operating parameter limits; performance testing; operations and maintenance requirements; and recordkeeping and reporting requirements. The CC plant under Alternative A is possibly a HAP major source; however, that designation will ultimately depend on the emissions guarantees provided by the manufacturer.

Another NESHAP that applies to existing reciprocating internal combustion engines (RICE) at CUF and any proposed RICE under Alternatives A and B is 40 CFR 63, Subpart ZZZZ. In general, this rule has operational requirements for maintaining RICE and tracking their operating run time. For new emergency RICE at a major HAP source or new emergency/non-emergency RICE at a non-major HAP source, additional requirements might include complying with the applicable RICE New Source Performance Standard described in the following section. For new non-emergency RICE at a major HAP source, additional requirements might include emissions controls to reduce formaldehyde or carbon monoxide emissions.

The TDEC has promulgated rules for hazardous air pollutant controls under rules of TDEC Chapter 1200-03-31. These rules require major sources of hazardous air pollutants to implement Maximum Achievable Control Technology (MACT), and area sources may need to implement Generally Available Control Technology (GACT). Both MACT and GACT are case-by-case determinations that may include control equipment, work practice standards, emission standards, process modification, or raw materials substitution or reformulation, or both.

3.7.1.1.3. New Source Performance Standards (NSPS)

The USEPA has promulgated standards of performance for various emissions source categories with more significant emissions potential. These standards require new units to meet more stringent emissions limits and operational requirements than their older counterparts. The CC plant proposed at CUF and the CT plant option proposed at the Johnsonville and Gleason sites will be subject to 40 CFR 60, Subpart KKKK. This NSPS applies to stationary combustion turbines, both the combustion turbine engine and any associated heat recovery steam generator, for units that commenced construction after February 18, 2005. The key pollutants USEPA regulates from these sources includes NO_x and SO_2. The effects of this rule are discussed further in Section 3.7.2.

A NSPS for fossil fuel-fired electric utility steam generating units is outlined in 40 CFR Part 60, Subpart Da. Subpart Da covers fossil fuel-fired electric utility steam generating units that commenced construction after September 18, 1978, and are boilers capable of combusting over 250 MMBtu/hr of fossil fuel. These include units that were also constructed for the purpose of supplying more than one-third of their potential electric output capacity and more than 25 MW electrical output to any utility power distribution system for sale. The key pollutants USEPA regulates from these sources includes PM, NO_x, and SO_2. This rule does not apply to the proposed CT plants but could apply to the proposed CC plant at CUF because Subpart Da states that a facility meeting the applicability criteria of 40 CFR 60, Subpart KKKK, must meet the emission standards under that rule instead. In addition, Subpart KKKK states that a heat recovery steam generator or duct burner subject to Subpart KKKK is exempt from Subpart Da. However, the only pollutant of significant concern would be NO_x, which would be expected to be subject to a more stringent Best Available Control Technology (BACT) limitation than the applicable NO_x limit in this rule. In addition, TDEC has a comparable NSPS rule to the old

Subpart Da under TDEC Chapter 1200-03-16-.03 with emissions limits for these same three pollutants that would apply to the proposed CC plant. The older TDEC version of the federal Subpart Da does not have the exemption for units that are subject to Subpart KKKK, and thus, the TDEC NSPS (equivalent of the old federal Subpart Da) still applies to the proposed CC plant. However, the newer federally applicable Subpart KKKK limiting BACT will likely be as stringent or more stringent than the state Da limits.

Another NSPS that applies to fossil-fueled power plants, including the proposed CC and CT plants, is 40 CFR 60, Subpart TTTT. This 2015 final rule sets standards for GHG emissions from new (after January 8, 2014), modified, and reconstructed (after June 1, 2014) fossil fuel-fired power plants. For natural gas-fired CC plants (e.g., base load or intermediate load units), the rule has a CO2 emissions limit of 1,000 lbs./MWh. For natural gas-fired simple-cycle CTs (effectively peaking units), CO_2 emissions are limited to 120 pounds per Million British Thermal Units (lbs./MMBtu). To maintain compliance with "lbs/MMBtu" limit, a CT unit must adopt an annual generation restriction, which is based upon the unit's thermal efficiency. The effects of this rule are discussed further in Sections 3.7.2.3.1 and 3.7.2.4.1.

There are additional NSPS that apply to the ancillary sources found at natural gas-fired CC and CT power plants, such as those proposed at CUF and other locations. Ancillary sources may include auxiliary boilers, gas heaters, and RICE, both the compression ignition (CI) type and spark ignition (SI) type. Auxiliary boilers with heat input ratings between 10-100 MMBtu/hr would be subject to the NSPS under 40 CFR 60, Subpart Dc. However, for units that are fired with only pipeline quality natural gas, no emissions standards would apply under Subpart Dc. Instead, such units would be subject to reporting and recordkeeping requirements. Subpart Dc would also apply to dewpoint heaters rated at 10 MMBtu/hr or greater heat input. As with auxiliary boilers, dewpoint heaters > 10 MMBtu/hr that are fired with only pipeline quality natural gas would have no emissions standards under Subpart Dc, but would instead be subject to reporting and recordkeeping requirements. Auxiliary boiler units that are rated at 100 MMBtu/hr or greater would be subject to the NSPS under 40 CFR 60, Subpart Db. If such units are fired on only natural gas, the only applicable emission limit would be for NOx under Subpart Db. Usually, low-NOx burners, flue-gas recirculation technology, or some combination of the two, are sufficient to meet Subpart Db limits without post-combustion emission controls.

The RICE at CC and CT plants include emergency generators, black start generators[10], and emergency fire pump engines. The CI type are typically diesel fuel-fired and SI type are natural gas- or gasoline fired-engines. The NSPS requirements that apply are dependent on various design characteristics of the engines, when construction of the engines commenced, and whether they are for emergency or non-emergency purposes. In general, these NSPS requirements require either purchasing a USEPA-certified engine that meets specific emissions standards or installing, configuring, operating, and maintaining the engine per the manufacturer's instructions. The second option may require emissions performance testing.

3.7.1.1.4. Visibility Impairment and Regional Haze

Air pollution affects visibility, which is of particular importance within national parks and wilderness areas when pollutants are converted into visible particulates. The CAA designated national parks greater than 6,000 acres and wilderness areas greater than 5,000 acres as Class I protected areas to maintain their air quality. There are eight Class I areas in the vicinity of the TVA region: Great Smoky Mountains National Park; Mammoth Cave National Park; and the

[10] Black start is the ability of generation to restart parts of the power system to recover from a blackout.

Joyce Kilmer, Shining Rock, Linville Gorge, Cohutta, Sipsey, and Upper Buffalo Wilderness Areas. The Great Smoky Mountains National Park is the largest Class I area in the TVA region.

Visibility is determined by the ability of particles to scatter and absorb light and is expressed in units of inverse mega-meters or deciviews. Visibility thresholds have been established under 40 CFR 51, Appendix Y, which determine whether modeled visibility effects from a source are large enough to require installation of Best Available Retrofit Technology. These requirements, in addition to other regulatory programs, have resulted in significant progress towards attaining natural visibility conditions in the TVA region and nationwide.

The USEPA promulgated the Regional Haze Rule in 1999 to improve visibility in Class I protected areas with the goal to achieve natural background visibility by 2064. Significant improvements have occurred from 1990 through 2016 within the Great Smoky Mountains; between 44 and 47 percent improvement for best days and worst days, respectively (TVA 2019b).

Emissions of visibility impairing pollutants (e.g., ammonium sulfate from SO_2 emissions and particulate emissions) are significantly greater from coal-fired power plants compared to natural gas-fired power plants. TVA's plan to retire coal-fired power plants and replace them with natural gas-fired power plants is contributing to visibility improvements in TVA's service territory.

3.7.1.1.5. Acid Deposition

Acid deposition is primarily caused by SO_2 and NO_x emissions, which are transformed into sulfate (SO_4) and nitrate (NO_3) aerosols, then deposited onto surface waters through precipitation (rain, snow, or fog). This precipitation can cause acidification of these surface waters, which can adversely affect aquatic life, especially within sensitive ecosystems.

In 1990, CAA Amendments established the Acid Rain Program with the goal to reduce SO_2 and NO_x emissions from the power sector and the resulting acid deposition. Since regulations were implemented in 1995, significant reductions in these and other pollutants have occurred along with significant reductions in sulfate and nitrate deposition in surface waters. TVA's SO_2 emissions in Tennessee have decreased by 97 percent since 1990 and its NO_x emissions in the state have decreased by 95 percent from a peak in 1997 (TVA 2019b). The retirement of TVA coal-fired power plants has contributed to reductions in acid deposition and is expected to continue to further reduce acid deposition in TVA's service territory. Emissions of SO_2 from natural gas-fired power plants are significantly less than from coal-fired power plants due to natural gas having a much lower sulfur content. NO_x emissions from modern natural gas-fired combustion turbines are easily controllable to levels lower than with coal combustion. Meeting the NSPS and BACT limitations, if applicable, for natural gas-fired combustion turbines and ancillary natural gas-fired emission units, will generally result in substantially lower plantwide NO_x emissions compared to a coal-fired facility of similar electric generating capacity.

3.7.1.1.6. General Conformity

The USEPA requires federal non-transportation projects to undergo an air quality conformity analysis to ensure federal actions conform to the state or federal Implementation Plans. These requirements were promulgated on November 30, 1993 within 40 CFR 51 and 93 and were updated effective March 24, 2010. These General Conformity requirements only apply to federal actions within nonattainment and maintenance areas. Because all Alternatives under this Proposed Action occur in attainment areas, the General Conformity rule does not apply.

3.7.1.1.7. Air Quality Permitting for Construction and Operation

TDEC implements programs for permitting the construction and operation of new or modified stationary sources of air emissions in Tennessee that emit regulated pollutants. The TDEC rules for construction and operating permits are contained within the TDEC Division of Air Pollution Control Rules, Chapter 1200-03-09. Depending on the type and size of the emissions units and levels of regulated pollutants emitted, TDEC determines the applicable emission standards and associated requirements for inclusion in the issued construction permit.

The air quality permitting process begins with the application for a construction permit. Each proposed alternative, except the No Action Alternative and likely Alternative C, would require a permit to construct in one form or another. TDEC can issue four types of air quality construction permits for the construction and temporary operation of new or modified emissions sources that are potentially applicable to each proposed alternative (listed in order of highest complexity, stringency, and typical time to process):

- Prevention of Significant Deterioration (PSD) Permit (or PSD Permit Modification) in Attainment Area; Major Source permit
- Owner Requested Limit (ORL) Permit (synthetic minor permit to voluntarily limit emissions below PSD permit triggers or operating permit triggers)
- Minor Source permit
- Permit by Rule (applicability dependent on source type, size, and/or emissions from the source)

Issuance of the above construction permits by TDEC would establish federal and state air quality requirements applicable to each alternative. If these requirements are complied with, the construction permitting process would ensure compliance with the State Implementation Plan and ambient air quality standards.

Title V of the CAA requires states to establish an air operating permit program for stationary sources that exceed major source thresholds, which are dependent on the attainment status of the area (e.g., 100 tons per year (tpy) of any criteria pollutant in an attainment area). A Title V operating permit is also required for sources with potential to emit 10 tpy of any individual HAP, or 25 tpy of all HAPs combined. The requirements of Title V are outlined in the federal regulations in 40 CFR Part 70 and in the TDEC, Division of Air Pollution Control regulations within Section 1200-03-09-02. The permits required by these regulations are often referred to as Title V or Part 70 permits.

3.7.1.1.8. Greenhouse Gases and Climate

Greenhouse Gas Emissions

The Earth's atmospheric temperature is dependent on the balance between the amount of energy incoming from the sun and the amount reflected and radiated into space by the Earth's surface, clouds, gases, and small particles in the atmosphere. The primary GHG of concern, carbon dioxide (CO_2), is naturally exchanged between the atmosphere, plants, and animals through photosynthesis, respiration and decomposition, and between the atmosphere and oceans through gas exchange. Each year, billions of tons of CO_2 are absorbed by oceans and living biomass and emitted to the atmosphere through natural and human processes. GHGs in the atmosphere absorb heat that is radiated from the Earth's surface. An increase in the atmospheric concentration of GHGs results in trapping more heat and causing the Earth to

warm (TVA 2019b). Atmospheric levels of CO_2 have increased from below 300 ppm in 1900 to a global average of 412.5 ppm in 2020 (NOAA 2021), which is higher than scientists believe the Earth has experienced in over a million years. GHGs can remain in the atmosphere for differing periods of time, ranging from several years to thousands of years. Each GHG is assigned a global warming potential (GWP), which is an estimate of the relative amount of infrared radiation it absorbs in comparison to CO_2 on a pound-for-pound basis, projected over a 100- year period. The main GHG pollutants that apply to TVA operations and their GWPs are CO_2 GWP = 1; CH_4 (methane) GWP = 25; N_2O (nitrous oxide) GWP = 298; and SF6 (sulfur hexafluoride) GWP = 22,800 (40 CFR 98, Table A-1). For example, 1 pound of methane emissions is considered equivalent to 25 pounds of CO_2 emissions or CO_2-e.

Emissions of anthropogenic GHGs are estimated annually by the USEPA for the U.S. and each state for several sectors of the economy. In 2019, total CO_2 emissions for the entire U.S. were approximately 5,144 MMT, with electricity production accounting for approximately 25% of this total (29% transportation, 23% industrial, and 23% commercial, residential, and agriculture) or approximately 1,286 MMT. In that same year, U.S. net emissions decreased 1.7 percent compared to 2018 and decreased 13 percent from 2005. (USEPA 2021b). By comparison, emissions of CO_2 from TVA power plants decreased from 103.5 MMT in 1995 to 43.1 MMT in 2019, for a 58 percent reduction. This trend is mainly due to retirement of coal-fired plants and replacement with natural gas-fired plants, which have lower CO_2 emissions, and nuclear power generation, which has no CO_2 emissions (TVA 2019d).[11]

Climate Status and Projections

The climate in the TVA region is affected by a transition area between a humid continental climate to the north and a humid subtropical climate to the south. This results in temperatures that are generally mild with plenty of rainfall for agricultural and water uses. There is some vegetation-killing freezing from mid-autumn through early spring, occasional severe thunderstorms, infrequent snow, and infrequent effects from tropical storms. The seasonal climate variations cause a peak power demand in both the summer for cooling and winter for heating. Rainfall varies throughout the year but peaks in late winter/early spring and again in summer. Winds are strongest during winter and early spring and lightest between late summer and early autumn (TVA 2019b).

The TVA region, i.e., Tennessee area, average monthly temperature trends over a 30-year period from 1981 to 2010 show an overall warming trend of 0.4 to 0.5 degrees Fahrenheit per decade. The annual average trend for a 100+-year period from 1895 to 2015, based on least squares regression analysis, indicates a slight increase of 0.24 degrees Fahrenheit per 100 years with the annual average winter temperature increasing 0.67 degrees Fahrenheit per 100 years and the annual average summer temperature decreasing 0.09 degrees Fahrenheit per 100 years (TVA 2019b).

The TVA region precipitation trend over a 30-year period from 1981 to 2010 is not discernable as there is significant year-to-year variability. Annual average precipitation in the region was 49.92 inches, with monthly averages ranging between 2.6 inches in October to 4.73 inches in December, for this 30-year period. The annual average snowfall in most of the region is between 5 and 25 inches, with up to 100 inches in the higher elevations of the southern Appalachians in North Carolina and Tennessee. The annual total precipitation trend for the period between 1895 and 2017 increased at an average rate of 8 percent per 100 years, based

[11] GHG emissions data/reductions for different geographies during the same years and same exact parameters were not readily available for showing more direct comparisons.

on a linear regression analysis. The majority of this increase occurred prior to 1970 with no significant trend since that time (TVA 2019b).

Under a low GHG emissions increase scenario, the forecasted climate trends from the Fourth National Climate Assessment published in 2018 by the U.S. Global Change Research Program (USGCRP) predict higher average annual temperatures in the Southeast U.S. by 3.4 degrees Fahrenheit in 2050 and 4.4 degrees Fahrenheit higher by late century. However, the report notes that the temperatures in the southeast over the last century have not increased as much as the climate model projections anticipated from increases in atmospheric GHG concentrations that have already occurred. Additional higher emissions scenarios also show some deviations from observed trends that have occurred over the past century. Projections for changes in seasonal precipitation in the Southeast are generally within the range of natural variability, except for slightly greater winter precipitation predicted for much of the TVA region (TVA 2019b).

Potential climate change effects include more frequent and intense heat waves; increased damage from floods and major storm events; changes in precipitation patterns; damage from thawing permafrost and sea ice; reduced availability of freshwater during dry seasons; and harm to water resources, agriculture, wildlife, and ecosystems. Climate shifts could influence operational decisions to generate more or less power in the cold and warm seasons, but such changes would not appreciably affect how efficiently the TVA-wide power system operates or result in system failures, over all alternatives (USGCRP 2018).

GHG and Climate Assessment Methodology

For purposes of climate assessment, the study area for this EIS is the counties where the power plants are located with respect to local climate conditions, and with respect to GHG emissions, the study area is the global environment. This climate assessment study area more specifically includes the entire TVA power plant system.

The GHG emissions were analyzed for this EIS using the proxy method, supplemented with two separate types of Life Cycle Analysis (LCA). TVA used the proxy method to assess and compare climate effects and the net change in predicted estimates of GHG emissions for each alternative as a percent of State of Tennessee, U.S., and global GHG emissions. The two LCAs were performed for facilities that are directly part of each alternative, including their potential upstream and downstream GHG sources.[12]. An LCA was done on both an individual replacement resource by alternative (henceforth “individual”) and a TVA system-wide portfolio basis with simulated generation dispatch (henceforth “system-wide”). For the supplemental analyses, the system-wide LCA is important because implementation of each alternative has different impacts on the power generation mix throughout the TVA system. For example, Alternative A is estimated to indirectly reduce GHG emissions from other TVA coal plants as

[12] Upstream GHG sources include resource extraction/production, processing/conversion, material manufacturing, component manufacturing, delivery to site, construction for plant components, and the fuel cycle including fuel extraction/processing/distribution/transport and coal bed methane. Downstream GHG sources include dismantling, decommissioning, disposal, and recycling of the power generation facility. GHG emissions for the Alternative A pipeline construction and pipeline operational methane leak emissions are not separately presented but they are accounted for in the emissions calculations for the upstream and ongoing non-combustion life cycle segments; refer to Appendix I for details on this LCA. Emissions associated with the proposed natural gas pipeline are discussed qualitatively in detail in Section 3.7.2.3.2 below.

their load factors will likely decrease due to increased efficiency of the new CUF CC plant compared to the existing CUF coal plant.

The two LCAs also include the future estimated social costs of GHGs. The TVA system-wide LCA is focused on the estimated future GHG emissions and social costs for each proposed action in comparison to the No Action Alternative. The individual LCA provides the same comparison but focuses on estimated future total GHG emissions and social costs for the life cycle of each alternative without consideration of their effects on operation and dispatch of other TVA fleet facilities or resources. Lastly, future direct GHG operational emissions are also estimated and presented in terms of a comparison of existing GHG operational emissions to proposed direct GHG operational emissions at the specific sites under each alternative. The relative difference between estimated future direct GHG operational emissions for each alternative is compared to the No Action Alternative.[13]

The proxy method GHG analysis is provided in Section 3.7.2 and the TVA system-wide GHG LCA and the individual LCA for each alternative are summarized in Section 3.7.2 with more details provided in Appendix I. A description of the estimated future social costs of GHG (SC-GHG), uncertainty regarding their values and the range of values presented in this EIS, and a discussion of potential methane leak emissions is provided below.

The SC-GHG in this EIS collectively refers to the estimated future social cost of three main greenhouse gases: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Each of these GHGs has a unique social cost rate in units of dollars per metric ton of emissions. The SC-GHG attempts to monetize the net cost to society associated with adding an estimated amount of these three GHG to the atmosphere in a given year. In principle, it includes the value of all climate change impacts (both negative and positive), including (but not limited to) changes in net agricultural productivity; human health effects; property damage from increased flood risk and natural disasters; disruption of energy systems; risk of conflict; environmental migration; and the value of ecosystem services. In practice, estimates of the SC-GHG are unable to include all of the important physical, ecological, and economic impacts of climate change due to data and modeling limitations, and at best provide a range of values based on educated assumptions and predictions.

While governmental and non-governmental stakeholders have an interest in the future costs and effects of carbon emissions resulting from decisions, there is uncertainty and controversy surrounding the use of specific SC-GHG prices and associated escalation. Among the points of controversy are the selected economic discount rate and whether it is based on domestic effects or, more broadly, global effects given that the effects of GHG emissions are not restricted to the area of their origin. Another factor related to their use in NEPA analyses is that SC-GHG does not measure the actual incremental environmental effects of a project-level proposed action, since the social costs were for broader regulatory cost-benefit analysis. Nonetheless, the SC-GHG analysis has been included to supplement the proxy analysis since the SC-GHG analysis provides a rough means of comparing alternative actions by monetizing the potential environmental impacts of their estimated future GHG emissions.

[13] GHG and other pollutant emissions from construction activities would be temporary. Since the types, quantities, and activity levels of construction equipment are not known at this early stage, construction emissions are discussed in a qualitative manner. However, using general emission factors, they are quantitatively included in the LCA for each alternative.

Due to various, ongoing litigation and consequently legal uncertainty regarding the propriety of social cost of SC-GHG rates, the SC-GHG supplemental analysis presented in this EIS provides an SC-GHG range based on federal government published SC-GHG documents (e.g., USEPA or other federal government agency policy or Executive Orders). For example, there is a 2020 social cost of CO_2 (SCC) rate of $7 per metric ton at a 3 percent discount rate from the prior administration that only addresses domestic effects, and a Biden Administration 2020 SCC rate of $51 per metric ton at a 3 percent discount rate that addresses global effects. Presenting estimated future social costs as a range of values from successive Administrations provides decision-makers and the public with better information in an area fraught with uncertainty.[14] The social costs of methane (SCM) and nitrous oxide (SCN) are also provided in the LCAs based on their cost rates within the Biden Administration's Interagency Working Group interim guidance issued in February 2021 (IWG 2021). Under the prior administration, social cost rates were also presented for SCM and SCN in a 2020 U.S. Government Accountability Office (GAO) report entitled: Social Cost of Carbon, Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis (GAO 2020). The SC-GHG results for TVA system-wide effects essentially show that all the alternatives are relatively close regarding their overall potential GHG effects.

One of the GHGs mentioned above, methane, has been receiving more government and public attention due to the large recent increase in the production and consumption of natural gas, the primary source of methane, and its high global warming potential. Methane emissions from leaks in the natural gas production and transport sectors are being addressed in the natural gas industry. Kinder Morgan, the parent company of TGP that proposes to construct the natural gas pipeline, became a partner in the USEPA Natural Gas STAR Methane Challenge Program under the ONE Future Emissions Intensity Commitment Option. Members of this program commit to methane reduction goals and providing transparency by reporting annual methane emissions reductions to the USEPA (USEPA 2019). Kinder Morgan's current methane emissions intensity, the proportion of its total natural gas throughput that leaks from the Kinder Morgan natural gas transmission and storage facilities, of 0.03 percent is well below its transmission and storage allocation of the One Future Target 2025 goal of 0,031 percent for transportation and storage.[15] This leak rate would result in less than 2 percent of the net change in CO_2-e emissions from operational emissions due to Alternative A. In addition, the overall Methane Challenge Program leak rate for all members in 2020 was less than 0.5 percent of total natural gas flow for its entire life cycle (USEPA 2022a). Based on analysis of EPA data, the American Gas Association indicates that methane fugitive emissions across the entire natural gas supply chain (wellhead-transportation-storage-combustion) are typically around 1.0%, and leakage rates previously estimated by EPA are around 1.4% (AGA 2021). There are numerous ongoing industry and government efforts to further reduce methane leakage throughout the natural gas supply chain, resulting in a 16 percent reduction in total methane emissions from

[14] The 3 percent discount rate SC-GHG values under the prior administration were used under the LCA for each alternative because no SCM or SCN values were available at the 7 percent discount rate.
[15] 2021 Kinder Morgan Environmental, Social and Governance Report at 22 and 31, available at https://www.kindermorgan.com/WWWKM/media/Safety-Environmental/documents/2021_ESG_Report.pdf.
Natural gas exploration and processing methane leaks are more significant for the fuel cycle and would not be included in the Kinder Morgan 0.02% and 0.32% values. The sources/companies that would provide natural gas extraction/processing for Alternative A is variable and uncertain; therefore, estimates of their methane leak contribution is not known at this time.

natural gas systems between 1990 and 2019, a period when gross natural gas withdrawals almost doubled (AGA 2021).

Executive Orders Addressing GHG Emissions Reductions

President Biden issued Executive Order (EO) 14008 on January 27, 2021, which set forth a policy of a government-wide approach to address climate change.

President Biden issued EO 14057 on December 8, 2021, which established policies to reduce carbon emissions in the federal government sector as follows:

1. Use 100 percent carbon pollution-free electricity (CFE) by 2030, at least half of which will be locally supplied clean energy to meet 24/7 demand.
2. 65 percent reduction in Scope 1 (emissions from agency-owned or controlled emission sources) and Scope 2 (emissions from agency purchase of electricity, steam, heat, and cooling) GHG emissions as defined by the Federal Greenhouse Gas Accounting and Reporting Guidance, from federal operations by 2030 (2008 baseline).
3. Net-zero emissions from federal procurement no later than 2050, including a Buy Clean policy to promote use of construction materials with lower embodied emissions, i.e., upstream emissions from production of a product.
4. A net-zero emissions building portfolio by 2045, including a 50 percent emissions reduction by 2032 (2008 baseline).
5. Most significantly, net-zero emissions from overall federal operations by 2050.

One other carbon reduction policy in this EO that is not as pertinent to the proposed action is 100 percent zero-emission vehicle (ZEV) acquisitions by 2035, including 100 percent zero-emission light-duty vehicle acquisitions by 2027.

President Biden issued EO 14082 on September 12, 2022 to implement provisions from the Inflation Reduction Act. It reiterates the goal of reducing GHG emissions 50 to 52 percent by 2030 (2005 baseline), achieving a carbon pollution-free electricity sector by 2035, and achieving net-zero emissions by 2050. The EO further states that it shall be implemented consistent with applicable law and subject to the availability of appropriations.

Although all three action alternatives would help achieve the Administration's goal of reducing emissions from overall federal operations, Alternative C likely would go further in achieving the goals outlined in EO 14057 and 14082, the targets agreed to in The Paris Agreement, and National net zero policy. TVA remains committed to achieving the goals under these Executive Orders to the extent these goals can be achieved consistent with other statutory mandates under the TVA Act, such as the least-cost planning requirements and the requirement to provide power at rates as low as feasible. GHG mitigation measures and their impacts are further discussed in the Environmental Consequences section of this EIS.

As described in the TVA Strategic Intent and Guiding Principles document (May 2021), TVA has a plan for 70 percent TVA system-wide carbon reductions by 2030 (referenced to 2005 baseline), a path to ~80 percent carbon reductions by 2035, and aspires to net-zero carbon emissions by 2050. The entire TVA system has achieved 63% mass carbon emission reductions from 2005 to 2020.

3.7.1.2. CUF Reservation

The CUF Reservation is in Stewart County, which is an attainment area for all criteria pollutants (USEPA 2021c). Table 3.7-2 summarizes monitoring data for ozone, PM_{10}, and SO_2 (USEPA 2021d), the only three pollutants for which monitoring data are available for recent years within approximately 30 miles of CUF. The monitoring site for ozone is located at 5720 Old Dover Rd., Cadiz, Kentucky, approximately 28 miles northwest of the plant. The monitoring site for SO_2 is located at 2093 Ussery Rd. S., Clarksville, Tennessee, and at latitude/longitude coordinates 36.520298 west, -87.395500 north (WGS84), approximately 16 miles northeast of the power plant. The monitoring site for $PM_{2.5}$ is located at 1200 West Creek Coyote Trail, Clarksville, Tennessee, approximately 21 miles northeast of the power plant. The ambient monitor data for ozone indicates compliance with the NAAQS based on three-year averages, which is the basis for USEPA attainment/nonattainment designations. The ambient data for SO_2 and $PM_{2.5}$ is below the NAAQS but are not the formal validated values used to demonstrate compliance.

Table 3.7-2. Monitored Air Quality in Region of CUF

Pollutant	Averaging Period	Units	Monitored Design Concentrations [a]							
			2014	2015	2016	2018	2019	2020	2021	NAAQS
Ozone	8-hour	ppm	-	-	-	0.062	0.061	0.060	0.060	**0.070**
SO_2 [b]	1-hour	ppb	17	27	32	-	-	-	-	**75**
$PM_{2.5}$ [c]	24-hour	$\mu g/m^3$	-	-	-	-	15.1	14.6	21.5	**35**

[a] The design concentration is the monitored (ranked or percentile basis) concentration that would be used to assess compliance with the NAAQS.
[b] The monitoring site data for SO2 is from private company monitoring and has not gone through formal data validation or certification.
[c] The $PM_{2.5}$ concentrations are actual annual 98th percentile values as the 3-year average design values were either not available or presented as invalid.

Based on its potential to emit (PTE), the CUF currently operates under the conditions stipulated by Tennessee Air Pollution Control Board, (Title V) Operating Permit No. 577855 (June 30, 2026 expiration). This permit includes all applicable federal and state air quality requirements and includes the following emission sources: two main coal-fired power plant units (limited alternate fuel oil/used oil and wood allowed); two auxiliary oil-fired boiler units; material handling fugitive particulate emissions from handling/processing coal, limestone, hydrated lime for dust suppression, process additives, ash, and a gypsum by-product. In addition, air quality in Tennessee is protected by the suite of TDEC, Division of Air Pollution Control regulations within Chapter 1200-03.

3.7.1.3. Alternative A

The proposed CC Plant, short transmission line connections, and associated equipment would be located on the CUF Reservation. The air quality affected environment and existing conditions described above for the CUF Reservation in Section 3.7.1.2 apply to this plant and transmission corridor.

3.7.1.3.1. Natural Gas Pipeline Lateral Corridor

The proposed 32-mile natural gas pipeline would pass through Dickson, Houston, and Stewart counties. All three counties are currently in attainment for all criteria pollutants. There is no available air monitoring data for these counties in the USEPA air monitoring database or the TDEC air monitoring network.

3.7.1.4. Alternative B

3.7.1.4.1. JCT Reservation

The Johnsonville Reservation is in Humphreys County, which is in attainment for all criteria pollutants. The area around the reservation was a maintenance area for SO_2 between 1998 and 2018, when it returned to attainment status. According to USEPA air monitoring data, there are no air monitoring stations in Humphreys County or adjacent counties for any criteria pollutants (USEPA 2021d). In addition, there are no available air monitoring data for Humphreys County in the TDEC air monitoring network (TDEC 2021b).

The Johnsonville Reservation is a PSD major source and has been through a PSD construction permitting process for the existing CT units and associated equipment. Based on PTE, JCT is currently subject to Tennessee Air Pollution Control Board, Operating Permit No. 5728833 (November 25, 2023 expiration). This permit includes all applicable federal and state air quality requirements and includes the following emission sources: 20 natural gas or No. 2 fuel oil CT units totaling over 18,000 MMBtu/hr heat input capacity; four natural gas-fired heaters totaling over 35 MMBtu/hr heat input capacity; two emergency diesel engines; coal ash handling facility (historical coal use and handling of combustion residuals); and a historical ash disposal area for an ash settling pond. TVA also just approved the addition of 10 natural gas-fired Aeroderivative CTs at the Johnsonville Reservation. The Aero CTs would generate approximately 550 MW and are expected to be in commercial operation by December 31, 2024.

3.7.1.4.2. Gleason Reservation

The Gleason Reservation is in Weakley County, which is in attainment for all criteria pollutants. According to USEPA air monitoring data, there are no air monitoring stations in Weakley County or adjacent counties for any criteria pollutants (USEPA 2021d). In addition, there is no available air monitoring data for Weakley County in the TDEC air monitoring network. (TDEC 2021b)

The Gleason Reservation recently obtained a PSD New Source Review construction permit (Tennessee Air Pollution Control Board, PSD Permit No. 975023; June 1, 2020 expiration) to modify its existing CTs to allow unlimited hours of operation. These modifications have been completed; however, TDEC is in the process of incorporating this permit into the renewal of the existing Gleason Reservation Title V air operating permit (Tennessee Air Pollution Control Board, Operating Permit No. 562669; November 13, 2016 expiration). This permit includes applicable federal and state air quality requirements and includes the following emission sources: 3 CT units at 5,836 MMBtu/hr total heat input capacity; one natural gas fired heater (8 MMBtu/hr heat input capacity); and one emergency diesel fire water pump engines rated at 130 hp.

3.7.1.4.3. Transmission Corridors

As part of Alternative B, TVA would construct a 40-mile 500 kV transmission line through Henry and Weakley counties in Tennessee. Henry County is currently in attainment for all criteria pollutants as is Weakley County. According to USEPA air monitoring data, there are no air monitoring stations in Henry County or adjacent counties for any criteria pollutants (TDEC 2021b). In addition, there is no available air monitoring data for Henry County in the TDEC air monitoring network (TDEC 2021b).

3.7.1.5. Alternative C

3.7.1.5.1. Middle Tennessee TVA Power Service Area

Although locations of the proposed solar and storage facilities are not known, a large proportion of them would likely be in Middle Tennessee. All of Middle Tennessee is in attainment with all ambient air quality standards.

3.7.2. Environmental Consequences

3.7.2.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to operate the CUF coal-fired power plant. Criteria and HAP pollutant emissions from the continued operation of the plant would include emissions from the plant's boiler stacks, as well as associated emissions such as those from coal mining, handling and transportation activities; additive handling and transportation; and ash handling, disposal, and dust control. Emissions rates from CUF would be expected to remain similar to current levels. For example, the last 3-year average (2018 through 2020) for SO_2, NO_x, and PM_{10} emissions were 7,000+ tons/year, 4,000+ tons/year, and 1,400+ tons/year, respectively. Pollutants such as sulfuric acid, hydrogen fluoride, and hydrogen chloride would continue to be emitted in significant quantities as compared to no or minimal emissions of these pollutants under the other alternatives. CUF utilization may decrease if competing cleaner fuels such as natural gas continue to be cost competitive and renewable energy sources become more cost competitive. For the existing coal-fired units to remain operational, additional repairs and maintenance would be necessary to maintain reliability.

3.7.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

This section describes environmental consequences from the retirement, decommissioning, deactivation, decontamination, and deconstruction of the CUF plant. These activities and effects are expected to occur over a three-year period under all action alternatives.

Most buildings and structures at the CUF facility, approximately 2 million square feet in size, would be decontaminated (where needed) and demolished down to grade or just below grade level. The area would then be backfilled and provided with proper drainage. Short-term, direct contaminant and GHG emissions would occur due to the generation of fugitive dust and use of vehicles and off-road equipment in the decontamination and demolition process, transport of demolition debris and wastes to off-site recycling and disposal facilities, and movement and transport of fill materials and landscaping materials to restore portions of disturbed land that will not be redeveloped.

Fugitive particulate emissions from demolition activities typically produce particles that are mainly deposited on the property where the demolition occurs. The potential drift distance of particles is governed by the initial injection height of the particle, the terminal settling velocity of the particle, and the degree of atmospheric turbulence. Theoretical drift distance, as a function of particle diameter and mean wind speed, has been computed by the EPA for fugitive dust emissions. For a typical mean wind speed of 16 kilometers per hour (10 miles per hour) particles larger than about 100 micrometers (µm) are likely to settle out within 6 to 9 meters (20 to 30 feet) from the point of emission. Particles that are 30 to 100 µm in diameter are likely to settle within a few hundred feet from the point of emission. Smaller particles, particularly PM_{10}, and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) have much slower gravitational settling velocities and are much more likely to have their settling rate retarded by atmospheric turbulence, and thus be transported offsite (USEPA 2006). Site preparation and vehicular traffic over paved and unpaved roads at the site would also result in the emission of fugitive dust PM_{10}

during active deconstruction or demolition debris removal. The largest fraction (greater than 95 percent by weight) of fugitive dust emissions would be deposited within the demolition site boundaries. The remaining fraction of the dust would be subject to transport beyond the property boundary.

Most of the neighboring property around the CUF plant is either undeveloped, small farms, or limited industrial use. The closest residence to the decontamination and deconstruction project area is located approximately 0.65 miles to the east. Considering the distance from the plant, this location and more distant receptors would not be significantly impacted by fugitive dust emissions. There would also be the potential for an intense, short-term release of fugitive dust associated with the removal of the stacks or other larger structures by dropping with explosives. Fugitive dust would be released in an uncontrolled manner and would likely be released within several minutes, after which these emissions would cease. Dropping the stacks or structures via explosives would likely produce the most particulate matter of any site activity, with the highest potential to travel off the demolition site. The distance the particulate matter could travel would be dependent on the height of the dust column generated from demolition and wind and weather conditions during demolition.

To minimize potential fugitive dust mobilization associated with explosive demolition, the demolition contractor would be required, to the extent practical, to remove ash from the facilities proposed for deconstruction and demolition prior to removal of that facility and implement dust control measures during demolition to prevent the spread of dust, dirt, and debris. These methods may include wetting equipment and demolition areas, covering waste or debris piles, using covered containers to haul waste and debris, and wetting unpaved vehicle access routes during hauling. Wet suppression can reduce fugitive dust emissions from roadways and unpaved areas. TVA also requires onsite contractors to maintain engines and equipment in good working order (TVA 2021f).

Site preparation and vehicular traffic over paved and unpaved roads at the site would result in the emission of fugitive dust during active deconstruction, demolition debris removal, and restoration activities. The largest fraction of fugitive dust emissions would be deposited onsite within the demolition site boundaries. TVA and its contractors would comply with TDEC Air Pollution Control Rule 1200-3-8, which requires reasonable precautions to prevent PM from becoming airborne. If necessary, emissions from open demolition areas and paved/unpaved roads could be mitigated by spraying water on the work areas and roadways to reduce fugitive dust emissions (TVA 2021f).

Combustion of gasoline and diesel fuels by internal combustion engines (vehicles, generators, demolition equipment, etc.) would generate local emissions of particulate matter, CO, NO_x, SO_2, volatile organic compounds (VOCs), and CO_2 during the site preparation, demolition, and restoration periods. However, new emission control technologies and fuel mixtures have significantly reduced vehicle and equipment emissions. These vehicles and equipment would comply with the USEPA mobile source regulations in 40 CFR Part 85 for on-road engines and 40 CFR Part 1039 for non-road engines. These regulations include requiring a maximum sulfur content in diesel fuel of 15 ppm. Additionally, it is expected that all vehicles would be properly maintained, which would also reduce emissions (TVA 2021f).

Demolition debris and any scrap metal would be transported to an offsite vendor, landfill, or recycling facility by truck. Transport of these materials would occur along existing roadways in the vicinity of CUF and would result in increased emissions for the duration of the deconstruction process. Mitigation measures, including implementing BMPs for controlling

fugitive dust and proper maintenance of vehicles for controlling emissions, would help to minimize effects (TVA 2021f).

The use of vehicles and demolition equipment in the activities associated with this alternative, including offsite vehicle operations (such as debris disposal and workforce transportation), would result in a minor temporary increase in CO_2 emissions. There would also be a small risk of a release of pollutants and GHGs with high global warming potentials associated with handling and removal of refrigeration and electrical equipment during decontamination and deconstruction activities. Routine capture and recycling procedures are followed for these gaseous materials; therefore, most of these pollutants would not be released into the atmosphere. Additionally, such emission levels are expected to be de minimis in comparison to the total GHG emissions from each alternative and regional and world-wide volumes of GHG emissions.

Overall, these decontamination and deconstruction activities are expected to have short-term, localized, and minor effects on air quality and no appreciable direct or indirect effect on regional climate change. The effects from elimination of the CUF coal plant operational emissions are discussed below under Alternatives A, B, and C.

Under all Action Alternatives, potential emissions of greenhouse gases and fugitive dust could occur as a result of the deconstruction and construction activities. Similar emissions could be anticipated from the other projects in the area as a result of construction activities. One example is the JCT Aeroderivative project. The combined projects could cause cumulative minor, temporary effects to air quality in the area, which is discussed further in Section 3.7.2.4.3. Such effects would be mitigated through the use of best management practices, such as water suppression for dust control, and regular inspections and maintenance of construction vehicles.

3.7.2.2.1. Environmental Justice Considerations

Effects to air quality that would occur as a result of CUF coal facility retirement and D4 activities are not anticipated to have amplified environmental and human health effects on EJ populations in the CUF Reservation EJ study area. These effects would be short-term, minor, and generally limited to the TVA-owned CUF Reservation, with some chance of affecting a small area outside the CUF Reservation boundary. The immediate CUF Reservation vicinity, where fugitive dust emissions have some likelihood of becoming air borne, has low percentages of EJ populations, and overall, only two out of 16 census block groups are considered EJ across the study area (see Figure 3.4-3). While the EJ-qualifying census block groups had elevated percentages of environmental indicators, including particulate matter and air toxins, as compared with the state (and many nearby census block groups), residences within the two EJ-qualifying census block groups, Stewart County CT 1106 BG 1 and Houston County CT 1203 BG 3, both of which qualify as low-income, are located approximately 2.4 miles or more away from the CUF coal facility that would be demolished and, thus, have a low likelihood of being affected by fugitive dust emissions. They may experience some short-term increase in pollutants associated with transporting debris for disposal, but the impacts are expected to be minor and less than those associated with the closest residences (within 0.65 mile), which are within non-EJ qualifying block groups. Overall, long-term minor positive effects to EJ and other populations utilizing areas near or on the CUF Reservation may occur due to beneficial changes to local air quality from CUF retirement.

3.7.2.3. Alternative A

3.7.2.3.1. Construction and Operation of CC Plant at CUF Reservation

Under Alternative A, this Proposed Action component includes construction and operation of a 1,450 MW capacity natural gas CC plant on the CUF Reservation. The main plant components include two combustion turbines, two HRSGs, two auxiliary boilers, an air-cooling system, and an electric and diesel emergency fire water pump.

Construction Effects

Prior to construction of the CC Plant, TVA would apply for an air quality construction permit through the TDEC to complete construction and begin operations. An air construction permit approval and compliance with its terms and conditions, in combination with compliance with other requirements detailed below, minimize the risk of significant air quality effects.

The plant construction is expected to occur over 30 acres with an additional 10 to 20 acres used for equipment laydown and mobilization. Large equipment could be delivered by rail or barge with smaller items arriving by truck. Improvements to the current barge unloading facilities could consist of grading and creation of dirt/rock ramping to the nose of the barge as well as potential concrete resurfacing and widening. Emissions from material delivery and unloading by rail and barge would consist of fugitive dust and particulate matter, including CO, NO_x, SO_2, VOCs, and CO_2 emissions from combustion of fuels for material transport. These emissions are expected to be minor, and the rail and barge mobile sources would follow the applicable USEPA emissions standards for locomotive engines and marine diesel engines, respectively.

Construction of the CC plant will include use of on-road construction vehicles/trucks and off-road construction equipment for transporting the smaller building/equipment materials to the Reservation and erecting the facilities. Land clearing and grading activities would occur. Construction emissions are expected from gasoline and diesel fuel combustion within internal combustion engines for on-road vehicles/trucks and off-road equipment. These engines would generate local emissions of particulate matter, including CO, NO_x, SO_2, VOCs, and CO_2, during their operation. New emission control technologies and fuel mixtures have significantly reduced vehicle and construction equipment emissions. These vehicles and equipment would comply with the USEPA mobile source regulations in 40 CFR Part 85 for on-road engines and 40 CFR Part 1039 for non-road engines. These regulations include requiring a maximum sulfur content in diesel fuel of 15 ppm. A maximum of 600 workers would be employed on-site during peak construction activity. Their commuting vehicle emissions would be negligible compared to the other construction activity emissions.

Fugitive dust/particulate emissions would be generated during soil excavation and disturbance and truck traffic over paved and unpaved roads/areas. The largest fraction of fugitive dust emissions would be deposited in the immediate vicinity of the construction area. The smaller particulates would travel a little farther from the immediate construction area; however, those emissions are expected to be minor. The closest residence to the nearest location for the CC plant construction area, i.e., option A2, is located approximately 0.8 miles to the west-northwest. TVA and its contractors would comply with TDEC Air Pollution Control Rule 1200-3-8, which requires reasonable precautions to prevent PM from becoming airborne. In addition, dust control actions, including application of wetting agents or soil stabilization products on exposed soils and unpaved roads/travel areas, would be implemented to reduce fugitive dust/particulate emissions. Considering the distances from the proposed CC plant construction activities, the residential receptors would not be significantly impacted by fugitive dust emissions.

Stewart County is at least 140 kilometers from a federal Class I protected area. The expected combined emissions of SO_2, NO_x, and PM_{10} from the proposed CC plant in conjunction with this distance would result in visibility effects that do not exceed the regional haze screening criteria. Therefore, no regional haze requirements or PSD Class I effects analyses would apply under the permitting for construction of the new CC plant (AQ TVA 2021d).

Overall, the CC Plant construction activities are expected to have short-term, localized, and minor effects on air quality and no appreciable direct or indirect effect on regional climate change. Emissions will occur in an attainment area where current ambient levels of criteria pollutants are below ambient air quality standards and are not expected to appreciably change due to construction activities.

Operations Effects

The replacement of CUF coal-fired plant operations with natural gas-fired CC plant operations is expected to have long-term, moderate, beneficial effects on local air quality and on future regional GHG emissions in comparison to the No Action Alternative. The decrease in SO_2, NO_x, CO, PM (filterable only), PM_{10}, and $PM_{2.5}$ operational emissions at the CUF facility are estimated at 7,100+ tons/year, 3,800+ tons/year, 950+ tons/year, 222+ tons/year, 1,260+ tons/year, and 1,160+ tons/year, respectively. There would also be elimination of hydrogen fluoride and hydrogen chloride emissions and significant reductions in mercury and lead emissions along with reductions in other HAP emissions. Table 3.7-3 provides a comparison of estimated pollutant operational emissions for each alternative, both under the no action alternative and after implementation of each alternative, including the estimated net change in emissions. These emissions numbers are based on projected average annual lifetime electricity generation. Actual emissions could vary and at times be higher, but they would be accounted for during the construction air permitting process to ensure air quality ambient standards will be met.

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Table 3.7-3. Direct Estimated Air Emissions from TVA Facilities under Consideration

Pollutant	(Abbrev.)	CUF 3-Year Avg. Annual Emissions (2018-2020) (tons/yr)	Johnsonville 3-Year Avg. Annual Emissions (2018-2020) (tons/yr)	Gleason 3-Year Avg. Annual Emissions (2018-2020) (tons/yr)	Proposed CCs at CUF - Alternative A Emissions (tons/yr)	Proposed CTs at Johnsonville - Alternative B Emissions (tons/yr)	Proposed CTs at Gleason - Alternative B Emissions (tons/yr)	Net Change CUF Emissions - Alternative A (tons/yr)	Net Change Johnsonville Emissions - Alternative B (tons/yr) (1)	Net Change Gleason Emissions - Alternative B (tons/yr) (1)	Net Change Emissions - Alternative C - Solar/Battery Storage (tons/yr)
Particulate Matter/ Total Suspended Particulate (Filterable only)	PM/TSP	318.7	20.4	14.0	95.7	7.5	5.6	-223.0	7.5	5.6	-318.7
Total PM<10 microns (Filterable + Condensible)	PM_{10}	1,413.3	26.7	26.4	154.5	30.0	22.5	-1,258.8	30.0	22.5	-1,413.3
Total PM<2.5 microns (Filterable + Condensible)	$PM_{2.5}$	1,313.3	26.7	26.4	154.5	30.0	22.5	-1,158.8	30.0	22.5	-1,313.3
Sulfur Dioxide	SO_2	7,266.7	2.8	1.6	13.8	2.4	1.8	-7,252.9	2.4	1.8	-7,266.7
Nitrogen Oxides	NOx	4,050.0	135.1	188.7	185.6	131.2	98.5	-3,864.4	131.2	98.5	-4,050.0
Carbon Monoxide	CO	1,083.3	75.4	60.3	133.2	80.1	60.2	-950.1	80.1	60.2	-1,083.3
Volatile Organic Compounds	VOC	128.7	18.2	8.0	60.2	9.7	7.3	-68.5	9.7	7.3	-128.7
Sulfuric Acid	H_2SO_4	1,025.3	0.0	0.1	0.0	0.0	0.0	-1,025.3	0.0	0.0	-1,025.3
Ammonia	NH_3	4.0	2.3	0.0	154.3	0.0	0.0	150.3	0.0	0.0	-4.0
Carbon Dioxide	CO_2	10,500,000.0	476,000.0	315,000.0	2,760,529.8	474,460.7	355,990.4	-7,739,470.2	-4,775,539.3	-4,894,009.6	-10,500,000.0
Methane	CH_4	114.0	8.7	5.8	195.5	34.0	25.5	81.5	-23.0	-31.5	-114.0
Nitrous Oxide	N_2O	179.3	0.9	0.6	68.1	11.9	8.9	-111.2	-77.8	-80.8	-179.3
All GHGs	CO_2-e	10,566,666.7	478,000.0	315,666.7	2,785,716.4	478,841.3	359,276.2	-7,780,950.3	-4,804,492.0	-4,924,057.1	-10,566,666.7
Mercury	Hg	7.8E-03	1.6E-04	2.6E-06	No Data	No Data	No Data	-7.8E-03	-1.6E-04	-2.6E-06	-7.8E-03
Lead	Pb	1.0E-01	No Data	No Data	No Data	No Data	No Data	-1.0E-01	No Data	No Data	-1.0E-01

(1) = The Net Change in GHG operational emissions for Alternative B accounts for GHG emissions reductions from CUF coal retirement, due to GHG emissions having global impact, and those reductions are considered split evenly between Johnsonville and Gleason. Criteria/HAP pollutant emissions reductions from CUF coal retirement only have a more local region of influence and are not included in Alternative B Net Change in operational emissions.

Additional hazardous air pollutants are emitted but in negligible quantities, except for hydrogen fluoride (HF) and hydrogen chloride (HCl). HF and HCl emissions from coal burning would be eliminated with the switch to natural gas combustion turbines.
NA = Not Applicable

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The future predicted emissions presented above are from the TVA facilities under each alternative. These emissions calculations for the CCs were based on the following:

- Expected operational limits similar to BACT established for other, comparable CC units and associated equipment. (e.g., those established and published under the USEPA Reasonably Available Control Technology (RACT)/BACT/Lowest Achievable Emission Rate (LAER) Clearinghouse (RBLC) database).
- 40 CFR Part 75, App. D, 2.3.1.1.1, default SO_2 emission rate for firing pipeline natural (0.0006 lbs./MMBtu), which is prescribed by EPA for SO_2 emissions.
- Predicted annual average capacity factor of 55 percent based on Energy Information Agency (EIA) CC industry average over the last 10 years; from EIA website: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a. Actual CC capacity factors for any given plant in any given year may vary between about 35 and about 90 percent depending on factors such as load growth, natural gas prices, composition of the balance of TVA's generating fleet in any given year, outages, or other unforeseen circumstances.

Where the RBLC database was used, the lowest and highest limits were eliminated, and remaining limits were averaged; detailed emissions calculations are provided in Appendix H.

Due to NSPS requirements, more specifically 40 CFR 60 Subparts KKKK and TTTT, the new CCs would require emissions controls for NO_x and CO, and emissions limitations for SO_2 and CO_2 emissions. In addition, these rules would have emissions monitoring and/or performance testing requirements, fuel and fuel sulfur monitoring requirements, maintenance, recordkeeping, and reporting requirements. Reduction of NO_x emissions from the CTs (HRSG bypass operations) would be achieved through dry low- NO_x combustion systems. The CC plant would use a Selective Catalytic Reduction (SCR) system located within the HRSGs for additional NO_x reduction. Reduction of CO emissions would be achieved using a separate catalyst layer specifically for that pollutant. The new exhaust stacks would be equipped with continuous emissions monitoring systems.

After the CC plant begins operation, the existing Title V operating permit will require revisions to incorporate the new plant and associated air quality requirements and remove conditions regarding the existing coal-fired power plant.

Additional beneficial air quality effects from Alternative A include the following[16]:

- Elimination of mercury emissions by switching from coal to natural gas combustion, further enhancing compliance with the MATS rule.
- Elimination of hydrogen chloride and hydrogen fluoride emissions by switching to natural gas combustion.
- Reduction in acid precipitation deposition due to significant SO_2 and NO_x emissions reductions.
- Visibility impairment reductions due to significantly reduced PM, PM_{10}, $PM_{2.5}$, NO_x, and SO_2 emissions from coal combustion, handling, and transport.

[16] These air quality benefits would also be realized under Alternatives B and C but just at the CUF Reservation.

GHG Effects from Direct Emissions

The estimated decrease in future CO_2-e operational emissions at the CUF facility from implementation of Alternative A would be 7,780,950 tons in the first full year of the CC plant operation (anticipated in 2027). Commercial operation is expected to begin approximately June 2026 with final acceptance expected in December 2026; however, the highest annual CO_2-e emissions reductions begin in 2027. Similar annual reductions in CO_2-e operational emissions relative to the No Action Alternative would be experienced from that point forward. Estimated operational CO_2-e emissions in 2027 due to Alternative A from generation at the Cumberland site would be 74 percent below 2020 emissions, exceeding the Biden Administration goal of 65 percent reduction in Scope 1 GHG emissions by 2035 from a 2008 baseline.

For purposes of a general correlating measure of GHG effects, emissions of CO_2 from energy consumption are being used as that data is most readily available and consistent across state, U.S., and global data sources. Based on the most recent estimates of CO_2 emissions for Tennessee by the U.S. Energy Information Administration (USEIA), total emissions of CO_2 for the state in 2018[17] were 94.7 million metric tons (USEIA 2021). The most recent total U.S. CO_2 emissions due to energy consumption were 4,576.3 million metric tons from USEIA data for 2020. (USEIA 2022). The most recent total global CO_2 emissions due to energy consumption were 31,500 million metric tons from USIEA data for 2020 (USIEA 2021). Therefore, the estimated net decrease in emissions of 7 million metric tons of CO_2 per year associated with implementation of Alternative A would represent approximately 7.4 percent of total statewide emissions in 2018, approximately 0.15 percent of the total U.S. emissions in 2020, and 0.02 percent of the total global GHG emissions for 2020. As such, the operation of Alternative A would represent a beneficial reduction in future estimated GHG emissions, particularly from Tennessee's contribution to GHG emissions reductions.

Using the Biden Administration's 2021 SCC dollar per metric ton values, adjusted for inflation, the estimated net social benefit of CO_2 operational emissions reductions from implementing Alternative A in 2027 would be $475,973,587 for direct CO_2 effects. Table 3.7-4 provides the Biden Administration's social benefit, in dollars, of direct effect CO_2 operational emissions reductions for each alternative in 2027, when full year operations would begin. Using the prior administration's 2019 SCC dollar per metric ton values, adjusted for inflation, the estimated social benefit of carbon emissions reductions from implementing Alternative A in 2027 would be $54,176,292 for direct CO_2 effects. Table 3.7-5 provides the prior administration's social benefit, in dollars, of direct effect CO_2 operational emissions reductions for each alternative in 2027, when full year operations would begin. For both scenarios, beyond 2027 and at least through 2050, the net social benefit of CO_2 operational emissions reductions would increase year over year based on the increase in SCC rates ($/ton) between 2020 and 2050.

The CC Plant would also be subject to annual GHG emissions reporting to the USEPA. The annual threshold for reporting emissions is 25,000 metric tons of GHGs.

GHG Effects from Direct and Indirect Emissions – Life Cycle Analyses

Two GHG life cycle analyses (LCAs) were conducted for estimating future direct and indirect GHG emissions and associated social costs from implementing Alternative A. More detailed methodology and results for these analyses is provided in Appendix I. The first LCA is on an individual replacement resource by alternative basis (henceforth "individual") and the second is on a TVA system-wide portfolio basis with simulated system-wide generation dispatch. The Alternative A individual LCA is described below. The system-wide LCA for Alternative A is

[17] The most recent year for available statewide emissions data.

presented in Section 3.7.2.6 and provides the Alternative A LCA emissions and SC-GHG savings compared to the No Action Alternative. The Net Present Value (NPV) of these savings and their percent reduction compared to the No Action Alternative is also presented in Section 3.7.2.6.

Estimated emissions of the three main GHG pollutants, i.e., CO_2, CH_4, and N_2O, were calculated over the entire life cycle of Alternative A and broken down into four main life cycle segments: upstream; on-site ongoing combustion; ongoing non-combustion; and downstream. The activities under each segment are described in Appendix I. The operational life cycle of Alternative A was assumed to be 30 years based on current industry assumptions for typical expected operating life of a combined cycle natural gas plant. The resulting estimated life cycle emissions of each of the three GHGs were used to calculate the estimated future social cost of each GHG individually and the total SC-GHG. In the same manner as for GHG Effects from Direct Emissions above, the SC-GHGs were calculated using a range of SC-GHG values.

In summary, the Alternative A estimated LCA emissions of each GHG and their corresponding estimated future social costs are provided in Table 3.7-6 and Table 3.7-7. Table 3.7-6 provides the results using the Biden Administration social cost values and Table 3.7-7 provides the results using the prior administration social cost values. Both tables also provide an NPV of the total life cycle SC-GHG for Alternative A. It is important to understand that this LCA is for the individual assets being added under each alternative and does not account for power mix changes that would occur elsewhere in the rest of the TVA system. Therefore, it only provides a portion of the TVA system wide estimated future GHG emissions that would occur under each alternative.

In comparison to Alternatives B and C, Alternative A has the highest estimated CO_2-e life cycle emissions and associated estimated future social costs in nominal dollars. In comparison to the No Action Alternative, Alternative A has a 66 percent decrease in life cycle CO_2-e emissions and 65 percent decrease in associated estimated future social costs in nominal dollars. The total estimated life cycle SC-GHG for each alternative under Biden Administration values are: $34.92 billion – No Action Alternative; $12.15 billion – Alternative A; $3.54 billion – Alternative B; and $1.63 billion – Alternative C. The total estimated life cycle GHG social costs for each alternative under prior administration values are: $2.82 billion – No Action Alternative; $971.4 million – Alternative A; $282.9 million – Alternative B; and $135.2 million – Alternative C.

Table 3.7-4. Estimated Net Social Benefit of CO_2 Operational Emissions Reductions for Alternatives A, B, and C - Only Direct Effects to TVA Facilities (2027) – Biden Administration SCC Values

GHG Pollutant	(Abbrev.)	Nominal SCC Rate ($/mt) (2027)	Nominal SCC Rate ($/ton) (2027)	Net SCC Benefit - Alternative A (2027, Dollars)	Net SCC Benefit - Alternative B - Johnsonville (2027, Dollars)	Net SCC Benefit - Alternative B - Gleason (2027, Dollars)	Net SCC Benefit - Alternative B - Total (2027, Dollars)	Net SCC Benefit - Alternative C (2027, Dollars)
Carbon Dioxide	CO_2	$ 68	$ 61	**$ (475,973,587)**	**$ (293,693,305)**	**$ (300,979,166)**	**$ (594,672,470)**	**$ (645,744,801)**

Notes: 2027 SCC is presented as this is the first full year that Alternatives A and B are planned to begin operation. 3% discount rate used. Costs based on global impacts.

Social cost of Methane and Nitrous Oxide values are not presented because they are each insignificant, <1%, with regard to direct combustion emissions from all alternatives, when compared to the social cost of carbon, i.e., CO_2. However, they are calculated and presented in the GHG Life Cycle Analysis.

$ = U.S. Dollars; mt = metric tons; SCC = Social Cost of Carbon

Table 3.7-5 Estimated Net Social Benefit of CO_2 Operational Emissions Reductions for Alternatives A, B, and C - Only Direct Effects to TVA Facilities (2027) - Prior Administration SCC Values

GHG Pollutant	(Abbrev.)	Nominal SCC Rate ($/mt) (2027)	Nominal SCC Rate ($/ton) (2027)	Net SCC Benefit - Alternative A (2027, Dollars)	Net SCC Benefit - Alternative B - Johnsonville (2027, Dollars)	Net SCC Benefit - Alternative B - Gleason (2027, Dollars)	Net SCC Benefit - Alternative B - Total (2027, Dollars)	Net SCC Benefit - Alternative C (2027, Dollars)
Carbon Dioxide	CO2	$ 8	$ 7	**$ (54,176,292)**	**$ (33,428,775)**	**$ (34,258,067)**	**$ (67,686,842)**	**$ (73,500,000)**

Notes: 2027 SCC is presented as this is the first full year that Alternatives A and B are planned to begin operation. 3% discount rate used. Costs based on U.S. impacts only.

Social cost of Methane and Nitrous Oxide values are not presented because they are each insignificant, <1%, with regard to direct combustion emissions from all alternatives, when compared to the social cost of carbon, i.e., CO_2. However, they are calculated and presented in the GHG Life Cycle Analysis.

$ = U.S. Dollars; mt = metric tons; SCC = Social Cost of Carbon

Table 3.7-6. Alternative A - Estimated Life Cycle GHG Emissions and Associated Social Costs (Biden Administration Values, 3% Discount Rate)

Total Life Cycle CO_2 Emissions, tons	Total Life Cycle CH_4 Emissions, tons	Total Life Cycle N_2O Emissions, tons	Total Life Cycle CO_2-e Emissions, tons	Total Life Cycle Social Cost of CO_2 Emissions, $	Total Life Cycle Social Cost of CH_4 Emissions, $	Total Life Cycle Social Cost of N_2O Emissions, $	Total Life Cycle Social Cost of GHGs Emissions, Nominal $	NPV of Total Life Cycle Social Costs of GHG Emissions, 2021 $
97,327,461	415,573	2,043	108,325,747	$10,500,047,470	$1,568,340,006	$84,222,903	$12,152,610,379	$3,010,697,631

Note:
NPV = Net Present Value

Table 3.7-7. Alternative A - Estimated Life Cycle GHG Emissions and Associated Social Costs (Prior Administration Values, 3% Discount Rate)

Total Life Cycle CO_2 Emissions, tons	Total Life Cycle CH_4 Emissions, tons	Total Life Cycle N_2O Emissions, tons	Total Life Cycle CO_2-e Emissions, tons	Total Life Cycle Social Cost of CO_2 Emissions, $	Total Life Cycle Social Cost of CH_4 Emissions, $	Total Life Cycle Social Cost of N_2O Emissions, $	Total Life Cycle Social Cost of GHGs Emissions, Nominal $	NPV of Total Life Cycle Social Costs of GHG Emissions, 2021 $
97,327,461	415,573	2,043	108,325,747	$849,687,925	$116,413,206	$5,326,501	$971,427,632	$266,322,092

Note:
NPV = Net Present Value

Carbon capture and hydrogen fuel blending technologies are not currently available to incorporate in the current plant design because these technologies have not been demonstrated at the scale of the proposed CC plant under Alternative A and the current lack of available storage for carbon capture and available hydrogen at the scale needed to be efficient. If Alternative A is selected, TVA will ensure that proposed plant design enables and accommodates future modifications necessary for incorporating carbon capture and storage (CCS) and will obtain combustion equipment that can utilize hydrogen fuel blending as these technologies mature. TVA anticipates the efficiency, effectiveness, scalability, and economics of these systems will improve in the future, allowing for better decisions when adequate storage locations or pipelines are identified for both CCS and the delivery of hydrogen. Additional equipment could be incorporated into the former coal plant reservation after those areas are closed and remediated. Subsequent TVA IRPs would evaluate these developments and consider opportunities to incorporate them into TVA's existing system. If a viable option is identified in the future, TVA would conduct additional analyses to determine proposed pipeline routes, costs, storage requirements, or other needs with hydrogen fuel incorporation. Assuming incorporation of CCS and hydrogen fuel blending, the reduction in CO_2 emissions could be well over 90 percent. There would be an approximate similar reduction percent in SC-GHG at the time of implementation of the GHG mitigation. Typical current estimates of CCS reduction efficiency that may be achieved in the future are at 90 percent (MIT 2021). The GHG reduction from hydrogen fuel blending would depend on the percent of hydrogen fuel used and the method of producing the hydrogen.

Climate Change Effects on Alternative A CC Plant

The main impacts of climate change are the intense heatwaves and the increase in sea level due to the melting of ice due to increases in global temperatures. Impacts from climate change including increases in ambient temperatures would negatively affect combustion turbine efficiency; although the efficiency drop is estimated at 0.06 percent per degree Celsius rise above 15 degrees Celsius, or 59 degrees Fahrenheit. This could slightly increase the turbine emissions, but that increase is expected to be minimal assuming climate change results in an overall 1.5-degree Celsius rise by 2050 (Fernandez et al. 2021). These climate change-related increased temperature effects on Alternative A are the same for Alternatives B and C; therefore, they are not repeated under the comparable subsections for Alternatives B and C.

Approximately one-third of the available area where the new CC plant could be located (Site A2 identified in Figure 2.1-3) is within a 100-year flood plain; however, through further planning, the CC plant infrastructure would be located outside of the 100-year floodplain. The natural gas pipeline under Alternative A crosses the 100-year floodplain of several streams; however, operational effects due to flooding are not expected to be significant. Refer to the flood mitigation measures for Alternative A provided in Section 3.5.2.3.3 of this EIS.

Extended drought conditions are not expected to affect the physical infrastructure or operations for all alternatives as they are not dependent on significant water resources. Extended heat waves would reduce the efficiency of CC facilities and the amount of electricity they generate. TVA has developed a Climate Action Adaptation and Resiliency Plan to identify risks associated with and plan for climate change effects. This plan can be found on TVA's website or at the following website link: climate-action-adaptation-and-resiliency-plan-202123633b8e-2139-42c3-94b6-1bc7cb8101d7.pdf (azureedge.net).

3.7.2.3.2. Construction and Operation of Natural Gas Pipeline

Alternative A includes the related component of TGP's construction and operation of approximately 32 miles of new natural gas pipeline and associated infrastructure to supply fuel for the CC plant. No natural gas compression or heating is anticipated for this new pipeline. Compression at the CC plant site would be needed but would use electric-driven motors. Any fugitive emission releases of natural gas and its constituents (mainly methane) during TVA's operations are expected to be minimal compared to CO_2-e emissions from natural gas combustion based on available EPA GHG inventory data and industry data for participants in EPA's programs to track and reduce methane leak emissions. Estimated future GHG emissions for the Alternative A pipeline construction and potential pipeline operational methane leak emissions are not separately presented but they are accounted for in the upstream and ongoing non-combustion life cycle segments emissions calculations for the Alternative A LCA; refer to Appendix I for details on the LCA. An estimated 1.6 percent of total natural gas flow leakage rate was used to calculate methane emissions from the pipeline operation; see Appendix I for the source of this percentage.

As stated in TGP's Resource Report 9 (TGP 2022i):

> Construction of the pipeline would include use of on-road construction vehicles/trucks and off-road construction equipment (e.g., bulldozers, backhoes, welders, generators, etc.) for transporting the piping to the construction areas and digging, stringing, welding, and burying the pipeline. Limited land clearing activities and associated equipment are expected as most of the pipeline will be located adjacent to an existing electrical transmission line right-of-way. There may be some deep valley stream crossings that require more land clearing; however, it is not expected to be significant enough to cause air quality issues. Emissions from pipe welding are expected to be minimal and widely distributed over the 32-mile pipeline based on the nature of the pipeline welding process and equipment, especially when compared to other construction emissions. TGP would not conduct open burning during pipeline construction (TGP 2022i).
>
> Construction emissions are expected from gasoline and diesel fuel combustion within internal combustion engines for on-road vehicles/trucks and off-road equipment. These engines would generate local emissions of particulate matter, including CO, NO_x, SO_2, VOCs, and CO_2, during their operation and would be widely distributed across the 32-mile pipeline area. New emission control technologies and fuel mixtures have significantly reduced vehicle and construction equipment emissions. These vehicles and equipment would comply with the USEPA mobile source regulations in 40 CFR Part 85 for on-road engines and 40 CFR Part 1039 for non-road engines. These regulations include requiring a maximum sulfur content in diesel fuel of 15 ppm. Additionally, it is expected that all vehicles would be properly maintained, which would also minimize emissions.
>
> Fugitive dust/particulate emissions would be generated during soil excavation, disturbance, and covering activities and truck traffic over paved and unpaved roads/areas. The largest fraction of fugitive dust emissions would be deposited in the immediate vicinity of the construction area. The smaller particulates would travel farther from the immediate construction area; however, those emissions are expected to be minor and widely distributed over the entire 32-mile pipeline. TDEC Air Pollution Control Rule 1200-3-8 requiring the use of reasonable precautions to prevent particulate matter from becoming airborne will help minimize fugitive

particulate emissions. Dust control actions, including application of wetting agents or soil stabilization products on exposed soils and unpaved roads/travel areas, would be implemented to reduce fugitive dust/particulate emissions. To mitigate exhaust emissions, TGP would require its construction contractors to use low-sulfur diesel fuel in all construction equipment and vehicles that use diesel fuel and to limit the idling of equipment when possible (TGP 2022i). All vehicles and engines, when available and practical, must adhere to the more stringent EPA Tier 3 and 4 emissions standards.

TGP evaluates methane emission reduction technologies and work practices on an ongoing case-by-case basis. As an example, TGP utilizes low-bleed or no-bleed (air or electric driven) pneumatics whenever feasible. Also, TGP reduces pipeline segment blowdowns to the extent feasible while maintaining pipeline safety and minimizing adverse customer impacts. TGP uses maintenance methods (e.g., mechanical sleeves) that do not require pipeline blowdowns to the degree possible while maintaining pipeline integrity. When blowdowns are required, TGP follows a consistent process to evaluate and minimize blowdown emissions. As time and conditions permit, TGP uses existing compression, customer delivery, and/or temporary compression to reduce pipeline pressures prior to conducting blowdowns.

Finally, TGP follows a prescribed operation and maintenance procedure to review its pipelines for gas leaks. This procedure includes an annual leak inspection along the pipeline system, aerial patrols looking for signs of leakage, and annual inspections at meter stations. Additionally, each time that operations personnel visit meter stations, the meter stations are inspected for the presence of leaks (by smell). Leaks identified during the inspections described above are evaluated and repaired as appropriate. If the repair or replacement is technically infeasible, would require a vent blowdown, a compressor station shutdown, or would be unsafe to repair during operations, the repair or replacement is delayed until the next scheduled compressor station shut down for maintenance, but no longer than two years from discovery unless the shutdown would cause a greater release of natural gas than would be reduced by the repairs.

Given these mitigation measures, the potential impacts of emissions during construction would be insignificant (TGP 2022i).

3.7.2.3.3. Transmission and Other Components

Alternative A includes construction activities to connect existing electrical transmission lines to the proposed CCs and to upgrade certain on-site and off-site transmission line equipment to accommodate the new plant. The affected area on the CUF reservation includes up to four new 500kV transmission lines with a length of approximately one mile each and an overall width of approximately 300 feet. The off-site affected area consists of approximately six miles of new fiber optic lines along an existing 500-kV transmission line. These activities would occur on and adjacent to the CUF plant property and would generate temporary and minor amounts of fugitive dust from vehicular and equipment travel over paved and unpaved roads. In addition, temporary and minor helicopter and fugitive dust emissions would occur to install the fiber optic lines. TDEC Air Pollution Control Rule 1200-3-8, which requires reasonable precautions to prevent particulate matter from becoming airborne, would apply to minimize fugitive emissions. Fugitive dust control actions would be implemented, including application of wetting agents or soil stabilization products on exposed soils and unpaved roads/travel areas.

Highway vehicles, off-road mobile equipment, and helicopters would generate minor amounts of combustion emissions, including particulate matter, such as CO, NO_x, SO_2, VOCs, and CO_2 from diesel, gasoline, and aviation fuel for internal combustion and turbine engines. New emission control technologies and fuel mixtures have significantly reduced vehicle and construction equipment emissions. These vehicles and equipment would comply with the USEPA mobile source regulations in 40 CFR Part 85 for on-road engines and 40 CFR Part 1039 for non-road engines. These regulations include requiring a maximum sulfur content in diesel fuel of 15 ppm. Additionally, it is expected that all vehicles would be properly maintained, which would also reduce emissions. Helicopters would comply with applicable aircraft or rotary-wing engine emissions standards.

There are typically no operational emissions from the transmission lines and associated electrical equipment. If some electrical equipment (e.g., electrical switchgear, circuit breakers) contains the GHG sulfur hexafluoride gas, which has a very high global warming potential, there may be a potential for minor leaks, mostly associated with maintenance or long-term equipment degradation. Through routine preventative maintenance programs, leaking equipment would be identified and remedied or replaced. As such, their emissions are expected to be minimal or negligible. In addition, due to newer equipment, more efficient operation and maintenance techniques, and leak detection, these features would minimize sulfur hexafluoride emissions.

Overall, these transmission line construction and upgrade activities are expected to have short-term, minimal effects on air quality and no appreciable direct or indirect effect on regional climate change. The operation of the transmission lines and associated equipment is expected to have long-term, minimal effects on air quality and no appreciable direct or indirect effect on estimated future regional GHG emissions.

3.7.2.3.4. Summary of Alternative A

The construction of the CC plant for Alternative A is expected to have short-term. localized, and minor effects on air quality and short-term, regional, and minor effects from GHG emissions on climate change. With the decommissioning and demolition of the CUF coal-fired plant, the operation of the CC plant is expected to have long-term, moderate, beneficial effects on local air quality and reductions in future regional GHG emissions are expected to have long-term, minor, beneficial effects on climate change in comparison to the No Action Alternative. The construction and operation of the new natural gas pipeline and associated infrastructure would have short-term, localized, and minor effects on air quality and short-term, regional, and minor effects from GHG emissions on climate change. The transmission line construction and upgrade activities are expected to have short-term, minimal effects on air quality and no appreciable direct or indirect effect on regional climate change.

For Alternative A, the social cost benefit from CO_2 operational emissions reductions is estimated to be between $54 million and $476 million dollars the first year of operation, in nominal dollars, and would increase every year thereafter. On an individual replacement resource basis, the estimated total Alternative A life cycle social costs of GHG emissions ranges from approximately $971 million to $12 billion in nominal dollars. These values equate to between approximately $266 million and $3 billion in NPV to 2021 dollars. On a TVA system-wide basis, the estimated total Alternative A life cycle social costs of GHG emissions in comparison to the No Action Alternative, i.e., net savings/benefit, ranges from approximately $1.1 billion to $12 billion in nominal dollars. These savings/benefit values equate to between approximately $418 million

and $4.4 billion in NPV to 2021 dollars.[18] In comparison to Alternatives B and C, Alternative A has the highest estimated GHG life cycle emissions and associated estimated future social costs; however, other considerations such as the need for firm, dispatchable power and the need to have this power in place by 2026, would still lead TVA to identify Alternative A as the preferred alternative. In addition, the design of Alternative A is such that future implementation of carbon capture and storage and of hydrogen fuel blending, as these technologies become viable, could result in further significant GHG emissions reductions.

3.7.2.3.5. Environmental Justice Considerations

Effects to air quality that would occur as a result of the proposed CC plant and transmission line activities would be reduced in comparison with existing conditions and minimized through permitting and monitoring, as described above. However, the immediate CUF Reservation vicinity, where fugitive dust and particulate emissions have some likelihood of becoming air borne, is predominantly settled by EJ populations. Further, the areas within the EJ-qualifying census block groups had elevated percentages of environmental indicators, including particulate matter and air toxins, as compared with the state (and many nearby census block groups), and due to proximity and assumed vulnerability due to non-pollution stressors, EJ populations would likely be affected by fugitive dust emissions and would experience increased (amplified) effects as compared with the non-EJ qualifying block groups generally farther from CUF.

Effects to air quality would be minor and generally limited to the immediate pipeline corridor and construction area, and fugitive emission releases of natural gas and its constituents from the pipeline during operations are expected to be minimal compared with existing conditions with the CUF plant operational, the boundary of which is within the pipeline corridor EJ study area. The immediate pipeline corridor vicinity, where fugitive dust, particulate, and natural gas emissions have some but low likelihood of occurring, has varying percentages of both EJ and non-EJ populations, with the majority consisting of EJ populations (seven out of 10 census block groups are EJ populations; also see Figure 3.4-5). However, these emissions are expected to be minor and widely distributed over the entire 32-mile pipeline; therefore, both EJ and non-EJ populations would experience these effects. Although similar impacts may occur in the general population, there is potential that these effects could be amplified in EJ-qualifying Dickson County CT 602 BG 2, according to EJScreen, as this census block group has EJ indices between the 50th to 60th percentiles for particulate matter and air toxics associated with cancer risk and respiratory issues. Emissions of particulate matter and other pollutants from the facility would be mitigated in accordance with requirements in applicable regulations and facility air permit.

3.7.2.4. Alternative B

3.7.2.4.1. Construction and Operation of CT Plants at JCT and Gleason Reservations

Under Alternative B, TVA would construct and operate CT plants with a total electrical generation capacity of 884 MW on the JCT reservation and 663 MW on the Gleason Reservation. The main plant components on the JCT reservation include four CTs and three natural gas dew point heaters at 15 MMBtu/hr each and an electric-driven gas compressor. The main plant components on the Gleason Reservation include three CTs and three natural gas dew point heaters at 15 MMBtu/hr each and possibly an electric-driven gas compressor.[19] This

[18] A range of social costs is provided to account for using prior administration SC values and Biden Administration SC values.
[19] All dew point heaters will only operate at 50 percent of their rated capacity.

alternative also includes the retirement, decommissioning, decontamination, and deconstruction of the CUF Plant previously discussed above.

Construction Effects

The main plant construction on both Reservations is expected to occur on up to 10 acres with as much as 33 (for JCT) to 60 (for Gleason) acres available for equipment laydown, mobilization, and parking. Large equipment would be delivered by rail with smaller items arriving by truck. Emissions from material delivery and unloading by rail would consist of fugitive dust and particulate matter, including CO, NO_x, SO_2, VOCs, and CO_2 emissions from combustion of fuels for material transport. These emissions are expected to be minor, and the rail mobile sources would follow the applicable USEPA emissions standards for locomotive engines.

Construction of the CT plants will include use of on-road construction vehicles/trucks and off-road construction equipment for transporting building/equipment materials to the Reservations, excavating and ground disturbance, and erecting the facilities. Minimal land clearing would occur as the sites are largely cleared and grading would be minimized. Construction emissions are expected from gasoline and diesel fuel combustion within internal combustion engines for on-road vehicles/trucks and off-road equipment. These engines would generate local emissions of particulate matter, including CO, NO_x, SO_2, VOCs, and CO_2, during their operation. New emission control technologies and fuel mixtures have significantly reduced vehicle and construction equipment emissions. These vehicles and equipment would comply with the USEPA mobile source regulations in 40 CFR Part 85 for on-road engines and 40 CFR Part 1039 for non-road engines. These regulations include requiring a maximum sulfur content in diesel fuel of 15 ppm. A maximum of 180 workers would be employed at each Reservation during peak construction activity. Their commuting vehicle emissions would be negligible compared to the other construction activity emissions.

Fugitive dust/particulate emissions would be generated during soil excavation and disturbance and truck traffic over paved and unpaved roads/areas. The largest fraction of fugitive dust emissions would be deposited in the immediate vicinity of the construction areas. The smaller particulates would travel farther from the immediate construction area; however, those emissions are expected to be minor. The closest residence to the JCT reservation is located approximately 1,000 feet to the south. The closest residence to the Gleason Reservation property is located approximately 0.6 miles to the south. Considering these distances from the new CT plants' construction activities and their minor extent, these receptor locations and more distant receptors would not be significantly impacted by fugitive dust emissions. TVA and its contractors would comply with TDEC Air Pollution Control Rule 1200-3-8, which requires reasonable precautions to prevent particulate matter from becoming airborne, would help minimize fugitive dust emissions. Dust control actions, including application of wetting agents or soil stabilization products on exposed soils and unpaved roads/travel areas, would be implemented to reduce fugitive dust/particulate emissions.

Prior to construction of the CT plants, air quality construction permits would be required through the TDEC to complete construction and begin operations. Depending on actual equipment sizes, manufacturer's specifications for each major pollutant, and operational limitations that may be requested, some pollutants may trigger a PSD permit modification for each of the new plants at each Reservation. In that case, applicable BACT will be included in and implemented through permit conditions, where required by PSD requirements. Compliance with the PSD permit terms and conditions assures air quality effects will not be significant.

For the JCT reservation, Humphreys County is over 160 kilometers from of a federal Class I protected area. The expected combined emissions of SO_2, NO_x, and PM_{10} from the proposed CT plant in conjunction with this distance would not result in visibility effects that exceed the regional haze screening criteria. Therefore, no regional haze requirements or PSD Class I effects analyses would apply under the construction permitting of the new CT plant (USEPA 2021e).

For the Gleason Reservation, Weakley County is at least 120 kilometers from a federal Class I protected area. The expected combined emissions of SO_2, NO_x, and PM_{10} from the proposed CT plant in conjunction with this distance would not result in visibility effects that exceed the regional haze screening criteria. Therefore, no regional haze requirements or PSD Class I effects analyses would apply under the construction permitting of the new CT plant (USEPA 2021e).

Overall, the CT construction activities at both the JCT and Gleason reservations are expected to have short-term, localized, and minor effects on air quality and no appreciable direct or indirect effect on regional climate change. Emissions would occur in attainment areas where current ambient levels of criteria pollutants are below ambient air quality standards and are not expected to appreciably change due to construction activities.

Operations Effects

The addition of natural gas CT plant operations at the JCT reservation and Gleason reservation are expected to have long-term, minor effects on local air quality. These additions, along with the CUF plant retirement, are expected to have long-term, moderate, beneficial effects on regional climate change in comparison to the No Action Alternative. The net change (increases) in SO_2, NO_x, CO, PM (filterable only), PM_{10}, $PM_{2.5}$, and VOC operational emissions at the JCT reservation are estimated at 2+ tons/year, 131+ tons/year, 80+ tons/year, 7+ tons/year, 30+ tons/year, 30+ tons/year, and 9+ tons/year, respectively. The net change (increase) in SO_2, NO_x, CO, PM, PM_{10}, $PM_{2.5}$, and VOC operational emissions at the Gleason Reservation are estimated at 1+ tons/year, 98+ tons/year, 60+ tons/year, 5+ tons/year, 22+ tons/year, 22+ tons/year, and 7+ tons/year, respectively. Table 3.7-3 provides a comparison of estimated pollutant operational emissions for each alternative both before and after implementation of alternatives, including the estimated net change in facility emissions. Emissions presented are only due to directly impacted TVA facilities under each alternative. Emission calculations for the CTs were based on the following:

- Expected operational limits similar to BACT established for other, comparable CC units and associated equipment. (e.g., those established and published under the USEPA Reasonably Available Control Technology (RACT)/BACT/Lowest Achievable Emission Rate (LAER) Clearinghouse (RBLC) database).
- 40 CFR Part 75, App. D, 2.3.1.1.1, default SO_2 emission rate for firing pipeline natural (0.0006 lbs./MMBtu), which is prescribed by EPA for SO_2 emissions
- Predicted annual average capacity factor of 10 percent based on (EIA) CT industry average over the last 10 years; from EIA website: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a. Based on TVA's experience and industry knowledge, actual CT capacity factors for any given plant in any given year may vary between about 1% and about 35 % depending on natural gas prices and operational factors.

Where the RBLC database was used, the lowest and highest limits were eliminated, and the remaining limits were averaged. The detailed emissions calculations are provided in Appendix H. Reduction of NO_x emissions from the CTs would be achieved through dry low- NO_x (DLN) combustion systems.

Due to NSPS requirements, more specifically 40 CFR 60 Subparts KKKK and TTTT, the new CTs would also require emissions controls to limit NO_x emissions. The SO_2 and CO_2 emissions limitations under these rules would be met based on the use of pipeline quality natural gas. In addition, these rules would have emissions monitoring and/or performance testing requirements, fuel and fuel sulfur monitoring requirements, maintenance, recordkeeping, and reporting requirements. After the CT Plants begin operation, the existing Title V operating permits will require revisions to incorporate the new plants and associated air quality requirements.

GHG Effects from Direct Emissions

The estimated decrease in CO_2-e operational emissions based on the net changes at CUF and JCT and the net changes at the CUF and Gleason from implementation of Alternative B would be 4,775,539 tons and 4,894,009 respectively, in the first full year (2027) when the CT plants would be expected to operate. For purposes of this analysis, TVA assumes commercial operation to begin in mid-2026 with final acceptance in December 2026; however, the maximum annual CO_2-e emissions reductions begin in 2027. Similar annual reductions in CO_2-e operational emissions relative to the No Action Alternative would be experienced from that point forward. The estimated percent net reduction in actual operational CO_2-e emissions due to Alternative B would be 92 percent in 2027 from 2020, exceeding the Biden Administration goal of 65 percent reduction in Scope 1 GHG emissions by 2035 from a 2008 baseline.

For purposes of a general correlating measure of GHG effects, the estimated net decrease in emissions of 8.8 million metric tons of CO_2 per year associated with the implementation of Alternative B would represent approximately 9.3 percent of total statewide emissions in 2018, approximately 0.2 percent of the total U.S. emissions in 2020, and 0.03 percent of the total global GHG emissions for 2020. As such, the operation of Alternative B would represent a benefit to GHG emission reduction, particularly from Tennessee's contribution to GHG emissions reductions.

Using the Biden administration's 2021 SCC dollar per metric ton values, adjusted for inflation, the estimated net social benefit of CO_2 operational emissions reductions from implementing Alternative B at JCT and Gleason in 2027 would be $293,693,305 and $300,979,166, respectively, and total $594,672,470 for direct CO_2 effects (Table 3.7-4). Using the 2019 SCC dollar per metric ton values from the prior administration, adjusted for inflation, the estimated social cost benefit of CO_2 emissions reductions from implementing Alternative B at JCT and Gleason in 2027 would be $33,428,775 and $34,258,067, respectively, and total $67,686,842 for direct CO_2 effects (Table 3.7-5). For both scenarios, beyond 2027 and at least through 2050, the net social benefit of CO_2 operational emissions reductions would increase year over year based on the increase in SCC rates ($/ton) between 2027 and 2050.

The CT plants would also be subject to annual reporting to the USEPA regarding GHG emissions. The plants would exceed the 25,000 metric tons annual threshold for reporting.

GHG Effects from Direct and Indirect Emissions – Life Cycle Analyses

Two GHG life cycle analyses (LCAs) were conducted for estimating future direct and indirect GHG emissions and associated social costs from implementing Alternative B. More detailed

methodology and results for these analyses is provided in Appendix I. The first LCA is on an individual replacement resource by alternative basis (henceforth “individual”) and the second is on a TVA system-wide portfolio basis with simulated system-wide generation dispatch. The Alternative B individual LCA is described below. The system-wide LCA for Alternative B is presented in Section 3.7.2.6 and provides the Alternative B LCA emissions and SC-GHG savings compared to the No Action Alternative. The NPV of these savings and their percent reduction compared to the No Action Alternative is also presented in Section 3.7.2.6.

Estimated emissions of the three main GHG pollutants, i.e., CO_2, CH_4, and N_2O, were calculated over the entire life cycle of Alternative B and broken down into four main life cycle segments: upstream; on-site ongoing combustion; ongoing non-combustion; and downstream. The activities under each segment are described in Appendix I. The operational life cycle of Alternative B was assumed to be 30 years based on current industry assumptions for typical expected operating life for a combustion turbine natural gas plant. The resulting estimated life cycle emissions of each of the three GHGs were used to calculate the social cost of each GHG individually and the total SC-GHGs. In the same manner as for GHG Effects from Direct Emissions above, the social costs of GHGs were calculated using two GHG social cost rates.

In summary, the Alternative B estimated life cycle analysis emissions of each GHG and their corresponding estimated future social costs are provided in Table 3.7-8 and Table 3.7-9. Table 3.7-8 provides the results using the Biden Administration social cost values and Table 3.7-9 provides the results using the prior administration social cost values. Both tables also provide a NPV of the total life cycle SC-GHG for Alternative B. In comparison to Alternatives A and C, Alternative B has higher estimated CO_2-e life cycle emissions and associated future social costs than Alternative C but lower CO_2-e life cycle emissions and associated future social costs than Alternative A, in nominal dollars. In comparison to the No Action Alternative, Alternative B has an estimated 90 percent decrease in both life cycle CO_2-e emissions and associated future social costs in nominal dollars. The total estimated life cycle GHG social costs for each alternative under Biden Administration values are: $34.92 billion – No Action Alternative; $12.15 billion – Alternative A; $3.54 billion – Alternative B; and $1.63 billion – Alternative C. The total estimated life cycle GHG social costs for each alternative under prior administration values are: $2.82 billion – No Action Alternative; $971.4 million – Alternative A; $282.9 million – Alternative B; and $135.2 million – Alternative C.

Table 3.7-8. Alternative B - Estimated Life Cycle GHG Emissions and Associated Social Costs (Biden Administration Values, 3% Discount Rates)

Total Life Cycle CO_2 Emissions, tons	Total Life Cycle CH_4 Emissions, tons	Total Life Cycle N_2O Emissions, tons	Total Life Cycle CO_2-e Emissions, tons	Total Life Cycle Social Cost of CO_2 Emissions, $	Total Life Cycle Social Cost of CH_4 Emissions, $	Total Life Cycle Social Cost of N_2O Emissions, $	Total Life Cycle Social Cost of GHGs Emissions, Nominal $	NPV of Total Life Cycle Social Costs of GHG Emissions, 2021 $
28,056,648	129,419	624	31,478,103	$3,029,113,658	$488,416,883	$25,722,718	$3,543,253,259	$876,316,344

Note:
NPV = Net Present Value

Table 3.7-9. Alternative B - Estimated Life Cycle GHG Emissions and Associated Social Costs (Prior Administration Values, 3% Discount Rates)

Total Life Cycle CO_2 Emissions, tons	Total Life Cycle CH_4 Emissions, tons	Total Life Cycle N_2O Emissions, tons	Total Life Cycle CO_2-e Emissions, tons	Total Life Cycle Social Cost of CO_2 Emissions, $	Total Life Cycle Social Cost of CH_4 Emissions, $	Total Life Cycle Social Cost of N_2O Emissions, $	Total Life Cycle Social Cost of GHGs Emissions, Nominal $	NPV of Total Life Cycle Social Costs of GHG Emissions, 2021 $
28,056,648	129,419	624	31,478,103	$245,017,628	$36,253,719	$1,626,778	$282,898,125	$76,852,188

Note:
NPV = Net Present Value

Carbon capture and hydrogen fuel blending technologies are not currently considered in the current plant design because these technologies are too expensive and inefficient for the expected run times and output at a CT plant.

Climate Change Effects on Alternative B

The main impacts of climate change are the intense heatwaves, more severe storms, and the increase in sea level due to the melting of ice based on increases in global temperatures. Impacts from climate change, including increases in flooding events and severity, are not expected to have an appreciable effect on the physical infrastructure or operations for Alternative B. The Johnsonville CT plant would be located adjacent to the Tennessee River; however, it will be outside of a 100-year floodplain. The Gleason CT plant would be located 0.3 miles south of Middle Fork Obion River, where approximately 12 acres of the northern portion of the Gleason CT plant site is within the 100-year floodplain. However, the CT plant infrastructure would be located outside of the 100-year floodplain, where possible. Otherwise, flood damageable facilities would be constructed one foot above the 100-year floodplain. Refer to the flood mitigation measures for Alternative B provided in Section 3.5.2.3.3 of this EIS.

Extended drought conditions, should they occur, would not be expected to have an effect on the physical infrastructure or operations for all alternatives as they are not dependent on significant water resources. Extended heat waves would reduce the efficiency of CT facilities and the amount of electricity they generate. TVA has developed a Climate Action Adaptation and Resiliency Plan to identify risks associated with and plan for climate change effects. This plan can be found on TVA's website or at the following website link: climate-action-adaptation-and-resiliency-plan-202123633b8e-2139-42c3-94b6-1bc7cb8101d7.pdf (azureedge.net).

3.7.2.4.2. Transmission and Other Components

Alternative B includes construction activities to connect existing electrical TLs to the proposed CTs and to upgrade local TL equipment to accommodate the new plant. These activities would include adding and/or expanding circuit breakers and constructing new switchyards and substations with associated electrical equipment. In addition, a new 40-mile TL would be constructed from Weakley, Tennessee, to a substation on the Marshall-Cumberland 500 kV transmission line. Upgrades to off-site TLs servicing the CT plants would include various reconstruction activities. As part of these upgrades, existing access roads may require modifications, such as brush clearing or tree trimming, to allow for passage of equipment and bucket trucks.

Fugitive dust/particulate emissions would be generated during soil disturbance activities and truck traffic over paved and unpaved roads/areas. The largest fraction of fugitive dust emissions would be deposited in the immediate vicinity of the construction area. The smaller particulates would travel farther from the immediate construction area; however, those emissions are expected to be minor and widely distributed over the entire 40-mile TL. TDEC Air Pollution Control Rule 1200-3-8, which requires reasonable precautions to prevent PM from becoming airborne, would help minimize fugitive emissions. Dust control actions, including application of wetting agents or soil stabilization products on exposed soils and unpaved roads/travel areas, would be implemented to reduce fugitive dust/particulate emissions.

Highway vehicles and off-road construction equipment (e.g., bulldozers, backhoes, bucket trucks, boom trucks, forklifts) would generate minor amounts of combustion emissions including particulate matter, such as CO, NO_x, SO_2, VOCs, and CO_2 from diesel- and gasoline-fueled internal combustion engines. These emissions would be widely distributed over the 40-mile TL. New emission control technologies and fuel mixtures have significantly reduced vehicle and

construction equipment emissions. These vehicles and equipment would comply with the USEPA mobile source regulations in 40 CFR Part 85 for on-road engines and 40 CFR Part 1039 for non-road engines. These regulations include requiring a maximum sulfur content in diesel fuel of 15 ppm. Additionally, it is expected that all vehicles would be properly maintained, which would also reduce emissions.

There are typically no operational emissions from the transmission lines and associated electrical equipment. If some electrical equipment contains the GHG sulfur hexafluoride gas (e.g., electrical switchgear, circuit breakers), there could be minor leaks, mostly associated with maintenance or long-term equipment degradation. However, their emissions are expected to be minimal or negligible. The expectation is that minimal equipment is anticipated to contain sulfur hexafluoride and the quantities should be very small. In addition, due to newer equipment, more efficient operation and maintenance techniques, and leak detection, these features would minimize sulfur hexafluoride emissions.

Overall, these transmission line construction and upgrade activities are expected to have short-term, minimal effects on air quality and no appreciable direct or indirect effect on regional climate change. Construction emissions will occur in attainment areas across the entire 40-mile TL where current ambient levels of criteria pollutants are below ambient air quality standards and are not expected to appreciably change due to construction activities. The operation of the transmission lines and associated equipment is expected to have long-term, minimal, or negligible effects on air quality and no appreciable direct or indirect effect on regional climate change.

3.7.2.4.3. Summary of Alternative B

The construction of the CT plants for Alternative B is expected to have short-term. localized, and minor effects on air quality and short-term, regional, and no appreciable direct or indirect effects from GHG emissions on climate change. The operation of the CT plants is expected to have long-term, minor effects on local air quality. With the decommissioning and demolition of the CUF coal-fired plant, reductions in future regional GHG operational emissions are expected to have long-term, minor, beneficial effects on climate change in comparison to the No Action Alternative. The transmission line construction and upgrade activities are expected to have short-term, minimal effects on air quality and no appreciable direct or indirect effect on regional climate change.

For Alternative B, the social cost benefit from CO_2 operational emissions reductions is estimated to be between $67 million and $595 million dollars the first year of operation, in nominal dollars, and would increase every year thereafter. On an individual replacement resource basis, the estimated total Alternative A life cycle social costs of GHG emissions ranges from approximately $283 million to $3.5 billion in nominal dollars. These values are between approximately $77 million and $876 million in NPV to 2021 dollars. On a TVA system-wide basis, the estimated total Alternative A life cycle social costs of GHG emissions in comparison to the No Action Alternative, i.e., net savings/benefit, ranges from approximately $953 million to $10.4 billion in nominal dollars. These savings/benefit values are between approximately $361 million and $3.8 billion in NPV to 2021 dollars.[20] In comparison to Alternatives A and C on an individual replacement resource basis, Alternative B is between these two alternatives regarding GHG life cycle emissions and associated estimated future social costs. This same comparison on a TVA

[20] A range of social costs is provided to account for using prior administration SC values and Biden Administration SC values.

system-wide basis results in Alternative B with the least total life cycle social cost savings/benefit in comparison to the No Action Alternative.

3.7.2.4.4. Environmental Justice Considerations

Effects to air quality that would result from the construction of the proposed CT facilities and transmission line activities would generally be limited to the immediate vicinity of the TVA-owned reservations and the transmission line corridor and nearby public roads. There are no EJ populations or residences in the immediate vicinity of the Gleason Reservation, and no residences in the immediate vicinity of the JCT. However, EJ populations are present in the census block group that encompasses JCT (qualifying low-income populations) and in the census block group immediately to the west of JCT (qualifying minority populations) across the Tennessee River. Effects on air quality from the construction of the CT facilities would be short-term, localized, and minor, as discussed above, and would affect EJ populations given their proximity to the JCT, primarily as a result of potential construction transport activity. Because non-EJ populations are also adjacent to the JCT plant on the south side, where residences are more densely located than in the EJ areas, both EJ and non-EJ populations could experience the negative effects from construction of the facilities. Although similar impacts may occur in the general population, there is potential that these effects from plant construction could be amplified in EJ-qualifying Humphreys County CT 1305 BG 1 according to EPA's EJScreen, as this census block group has EJ indices between the 60th to 70th percentiles for particulate matter and air toxics associated with cancer risk and respiratory issues.

Similar emissions from the construction of the proposed CT facilities at JCT could be anticipated from other projects in the area as a result of construction activities and operations. One example is the JCT Aeroderivative project. The combined projects could cause cumulative minor, temporary effects to air quality in the area during construction. Such effects would be mitigated using BMPs, such as water suppression for dust control and regular inspections and maintenance of construction vehicles. EJ populations, like the nearby non-EJ populations, may experience cumulative effects from the implementation of Alternative B, and in EJ-qualifying Humphreys County CT 1305 BG 1, as discussed above, these effects could be more pronounced.

Cumulative air quality effects at JCT from the operation of the JCT Aeroderivative project (550 MW) would be largely offset by the retirement of 16 existing CTs at JCT (approximately 1,000 MW). The Aeroderivative project CTs will be more efficient than the existing CTs and have acquired a PSD permit, which incorporates BACT. The necessary PSD air quality analysis concluded that the Aeroderivative project meets ambient-air quality standards in the vicinity of JCT. These Aeroderivative CTs also enhance TVA-system wide flexibility and integrate increasing renewable power capacity, which increases overall TVA system-wide efficiency and reduces system-wide emissions.

Air quality effects from transmission line construction and upgrade activities are expected to be short-term, minimal, and widely distributed over the study area. Thus, minimal to no effects are anticipated on EJ populations from transmission line construction activities. Since EJ and non-EJ populations would experience these effects, they are not anticipated to be amplified for EJ populations.

3.7.2.5. Alternative C

3.7.2.5.1. Construction and Operation of Solar and Storage Facilities

Alternative C includes construction and operation of 3,000 MW of solar facilities and 1,700 MW of storage capacity at multiple locations with a large portion in the Middle Tennessee region.

This would utilize an average of 7.3 acres per MW based on previous solar construction projects, for a total of 21,900 acres. While the number of sites is dependent upon the generating capacity, TVA has assumed that generating 3,000 MW of solar would require approximately thirty 100 MW sites. The solar facilities include ground-mounted photovoltaic panels. The BESS facilities would consist of placing modular battery system containers, power inverters, transformers, and switchgear over concrete slabs. The battery containers are of steel construction, equipped with lithium-ion battery cells contacted together and placed in racks. They would contain an auxiliary system, HVAC system, fire protection system, auxiliary distribution board, and a lighting arrangement. The storage facilities would utilize about 10 to 15 acres per 40 MW based on TVA pilot projects, which would result in about 425 to 638 acres for 1,700 MW.

Construction Effects

Construction of the solar and storage facilities would include use of on-road construction vehicles/trucks and off-road construction equipment for transporting the solar panels, battery modules, electrical transmission lines, concrete, and supporting mechanical and electrical infrastructure to the construction areas and erecting the facilities. Limited land clearing and grading activities would occur as construction is expected on cropland or heavily disturbed land, where the amount of clearing and grading required to prepare the site is low relative to other land types.

Construction emissions are expected from gasoline and diesel fuel combustion within internal combustion engines for on-road vehicles/trucks and off-road equipment. These engines would generate local emissions of particulate matter, including CO, NO_x, SO_2, VOCs, and CO_2, during their operation. New emission control technologies and fuel mixtures have significantly reduced vehicle and construction equipment emissions. These vehicles and equipment would comply with the USEPA mobile source regulations in 40 CFR Part 85 for on-road engines and 40 CFR Part 1039 for non-road engines. These regulations include requiring a maximum sulfur content in diesel fuel of 15 ppm.

Fugitive dust/particulate emissions would be generated during soil excavation and disturbance and truck traffic over paved and unpaved roads/areas. The largest fraction of fugitive dust emissions would be deposited in the immediate vicinity of the construction area. The smaller particulates would travel farther from the immediate construction area; however, those emissions are expected to be minor and widely distributed over the multiple facility sites. TVA and its contractors would comply with TDEC Air Pollution Control Rule 1200-3-8, which requires reasonable precautions to prevent PM from becoming airborne. In addition, dust control actions, including application of wetting agents or soil stabilization products on exposed soils and unpaved roads/travel areas, would be implemented to reduce fugitive dust/particulate emissions.

Overall, the solar and storage facility construction activities are expected to have short-term, localized, and minor effects on air quality and no appreciable direct or indirect effect on regional climate change. Emissions are expected to occur in attainment areas across the Middle Tennessee region where current ambient levels of criteria pollutants are below ambient air quality standards and are not expected to appreciably change due to construction activities.

Operations Effects

Operation of the solar and storage facilities are not expected to produce any appreciable emissions. There may be some heating requirements for some of the ancillary structures or the battery system structures; however, the heaters are expected to have no emissions, as they

would be electric. The solar and storage facilities are not expected to require emergency generators or other stationary internal combustion engines for emergency or non-emergency purposes. If some electrical equipment contains the GHG sulfur hexafluoride gas, which has a very high global warming potential, there could be minor leaks, mostly associated with maintenance or long-term equipment degradation. However, their emissions are expected to be minimal or negligible. The expectation is that minimal equipment is anticipated to contain sulfur hexafluoride and the quantities should be very small. In addition, due to newer equipment, more efficient operation and maintenance techniques, and leak detection, these features would minimize sulfur hexafluoride emissions.

The solar and storage facility operations are expected to have long-term, moderate, beneficial effects on air quality and on regional climate change in comparison to the No Action Alternative. The decrease in SO_2, NO_x, CO, PM, PM_{10}, $PM_{2.5}$, and VOC operational emissions at the CUF facility are estimated at 7,260+ tons/year, 4,050+ tons/year, 1,080+ tons/year, 310+ tons/year, 1,400+ tons/year, 1,300+ tons/year, and 120+ tons/year, respectively. There would also be elimination of hydrogen fluoride, hydrogen chloride emissions, mercury, and lead emissions, along with other HAP emissions. The detailed emissions calculations are provided in Appendix H.

The solar and storage facilities are not expected to require an air construction or operating permit for stationary sources of emissions.

GHG Effects from Direct Emissions

The estimated decrease in CO_2-e operational emissions at the CUF facility from the implementation of Alternative C would be 10,566,667 tons in the first full year when all solar and storage facilities would begin operation (anticipated in 2027). For modeling purposes, it was assumed that commercial operation would begin in mid-2026 (with final acceptance in December 2026 and the maximum annual CO_2-e emissions reductions beginning in 2027). Similar annual reductions in CO_2-e operational emissions would be experienced from that point forward. However, new solar facilities could not be built and operational within the modeled timeframe and would require additional time for completion of permitting, design, and construction phases. The percentage net reduction in actual operational CO_2-e emissions due to Alternative C would be 100 percent by 2035, exceeding the Biden Administration's goal of a 65 percent reduction in Scope 1 GHG emissions by 2035 from a 2008 baseline.

For purposes of a general correlating measure of GHG effects, the estimated net decrease in emissions of 9.5 million metric tons of CO_2 per year associated with implementation of Alternative C would represent approximately 10.1 percent of total statewide emissions in 2018, approximately 0.21 percent of the total U.S. emissions in 2020, and 0.03 percent of the total global GHG emissions for 2020. As such, the operation of Alternative C would represent a benefit to climate change, particularly from Tennessee's contribution to GHG emissions reductions..

Using the Biden administration's 2021 SCC dollar per metric ton values, adjusted for inflation, the estimated net social benefit of CO_2 operational emissions reductions from implementing Alternative C in 2027 would be $645,744,801 for direct CO_2 effects. Table 3.7-4 provides the Biden Administration's net social benefit, in dollars, of direct effect CO_2 operational emissions reductions for each alternative in 2027, when full year operations would begin. Using the 2019 SCC dollar per metric ton values from the prior administration, adjusted for inflation, the estimated net social benefit of carbon emissions reductions from implementing Alternative C in 2027 would be $73,500,000 for direct CO_2 effects. Table 3.7-5 provides the prior

administration's net social benefit, in dollars, of direct effect CO_2 operational emissions reductions for each alternative in 2027, when full year operations would begin. Beyond 2027 and at least through 2050, the net social benefit of CO_2 operational emissions reductions would increase year over year based on the increase in SCC rates ($/ton) between 2020 and 2050.

GHG Effects from Direct and Indirect Emissions – Life Cycle Analyses

Two GHG life cycle analyses (LCAs) were conducted for estimating future direct and indirect GHG emissions and associated social costs from implementing Alternative C. More detailed methodology and results for these analyses is provided in Appendix I. The first LCA is on an individual replacement resource by alternative basis (henceforth "individual") and the second is on a TVA system-wide portfolio basis with simulated system-wide generation dispatch. The Alternative C individual LCA is described below. The system-wide LCA for Alternative C is presented in Section 3.7.2.6 and provides the Alternative C LCA emissions and SC-GHG savings compared to the No Action Alternative. The NPV of these savings and their percent reduction compared to the No Action Alternative is also presented in Section 3.7.2.6.

Estimated emissions of the three main GHG pollutants, i.e., CO_2, CH_4, and N_2O, were calculated over the entire life cycle of Alternative C broken down into four main life cycle segments: upstream; on-site ongoing combustion; ongoing non-combustion; and downstream. The activities under each segment are described in Appendix I. The operational life cycle of Alternative C was assumed to be 20 years; however, emissions and associated social costs were prorated to 30 years to provide a consistent comparison to the other alternatives. The resulting estimated life cycle emissions of each of the three GHGs were used to calculate the social cost of each GHG individually and the total SC-GHGs. In the same manner as for GHG Effects from Direct Emissions above, the social costs of GHGs were calculated using a range of GHG social cost rates.

In summary, the Alternative C estimated life cycle analysis emissions of each GHG and their corresponding estimated future social costs are provided in Table 3.7-10 and Table 3.7-11. Table 3.7-10 provides the results using the Biden Administration social cost values and Table 3.7-11 provides the results using the prior administration social cost values. Both tables also provide a NPV of the total life cycle SC-GHG for Alternative C. In comparison to Alternatives A and B, Alternative C is below these two alternatives regarding estimated CO_2-e life cycle emissions and associated costs, in nominal dollars. In comparison to the No Action Alternative, Alternative C has an estimated 95 percent decrease in life cycle CO_2-e emissions and 95 percent decrease in associated estimated future social costs, in nominal dollars. The total estimated life cycle SC-GHG for each alternative under Biden Administration values are: $34.92 billion – No Action Alternative; $12.15 billion – Alternative A; $3.54 billion – Alternative B; and $1.63 billion – Alternative C. The total estimated life cycle SC-GHG for each alternative under prior administration values are: $2.82 billion – No Action Alternative; $971.4 million – Alternative A; $282.9 million – Alternative B; and $135.2 million – Alternative C.

Table 3.7-10. Alternative C - Estimated Life Cycle GHG Emissions and Associated Social Costs (Biden Administration Values, 3% Discount Rates)

Total Life Cycle CO_2 Emissions, tons	Total Life Cycle CH_4 Emissions, tons	Total Life Cycle N_2O Emissions, tons	Total Life Cycle CO_2-e Emissions, tons	Total Life Cycle Social Cost of CO_2 Emissions, $	Total Life Cycle Social Cost of CH_4 Emissions, $	Total Life Cycle Social Cost of N_2O Emissions, $	Total Life Cycle Social Cost of GHGs Emissions, Nominal $	NPV of Total Life Cycle Social Costs of GHG Emissions, 2021 $
16,767,825	60	0.6	16,769,502	$1,633,945,043	$203,337	$20,897	$1,634,169,277	$1,051,019,292

Note:
NPV = Net Present Value

Table 3.7-11. Alternative C - Estimated Life Cycle GHG Emissions and Associated Social Costs (Prior Administration Values, 3% Discount Rates)

Total Life Cycle CO_2 Emissions, tons	Total Life Cycle CH_4 Emissions, tons	Total Life Cycle N_2O Emissions, tons	Total Life Cycle CO_2-e Emissions, tons	Total Life Cycle Social Cost of CO_2 Emissions, $	Total Life Cycle Social Cost of CH_4 Emissions, $	Total Life Cycle Social Cost of N_2O Emissions, $	Total Life Cycle Social Cost of GHGs Emissions, Nominal $	NPV of Total Life Cycle Social Costs of GHG Emissions, 2021 $
16,767,825	60	0.6	16,769,502	$135,163,159	$15,462	$1,353	$135,179,973	$87,738,699

Note:
NPV = Net Present Value

Climate Change Effects on Alternative C

The main impacts of climate change are the intense heatwaves, more severe storms, and the increase in sea level due to the melting of ice based on increases in global temperatures. Impacts from climate change, including increases in flooding events and severity, are not expected to have an appreciable effect on the physical infrastructure or operations for Alternative C. Solar/storage facilities would be located to avoid 100-year flood plains, where possible, or constructed at least one foot above the 100-year flood plain level for components that are flood-damageable. Refer to the flood mitigation measures for Alternative C provided in Section 2.3 of this EIS.

Extended drought conditions, should they occur, are not expected to have an effect on the physical infrastructure or operations of the solar and storage facilities as they have minimal water requirements. Extended heat waves would reduce the efficiency of PV facilities and the amount of electricity they generate. Similarly, extended heat waves would reduce the efficiency of storage facilities by increasing their cooling system energy requirements. TVA has developed a Climate Action Adaptation and Resiliency Plan to identify risks associated with and plan for climate change effects. This plan can be found at the following website link: climate-action-adaptation-and-resiliency-plan-202123633b8e-2139-42c3-94b6-1bc7cb8101d7.pdf (azureedge.net).

3.7.2.5.2. Transmission and Other Components

Alternative C includes construction activities to connect existing electrical transmission lines to the multiple solar (assuming thirty 100 MW sites) and battery storage facilities and to upgrade local transmission line equipment to accommodate the new facilities. These activities would mainly occur in Middle Tennessee and are assumed to occur in attainment areas. Based on past TVA solar projects, new transmission interconnection lines to each solar and storage facility are expected to be short and the new lines and other transmission system upgrades would occupy limited acreage.

Fugitive dust/particulate emissions would be generated during soil disturbance activities and vehicle/truck traffic over paved and unpaved roads/areas. The largest fraction of fugitive dust emissions would be deposited in the immediate vicinity of the construction area. The smaller particulates would travel farther from the immediate construction area; however, those emissions are expected to be minor and widely distributed over the entire Middle Tennessee area. TVA and its contractors would comply with TDEC Air Pollution Control Rule 1200-3-8, which requires reasonable precautions to prevent PM from becoming airborne. In addition, dust control actions, including application of wetting agents or soil stabilization products on exposed soils and unpaved roads/travel areas, would be implemented to reduce fugitive dust/particulate emissions.

Highway vehicles and off-road construction equipment (e.g., bulldozers, backhoes, bucket trucks, boom trucks, forklifts, trenching equipment) would generate minor amounts of combustion emissions, including particulate matter, such as CO, NO_x, SO_2, VOCs, and CO_2 from diesel and gasoline fueled internal combustion engines. These emissions would be widely distributed over the entire Middle Tennessee area. New emission control technologies and fuel mixtures have significantly reduced vehicle and construction equipment emissions. These vehicles and equipment would comply with the USEPA mobile source regulations in 40 CFR Part 85 for on-road engines and 40 CFR Part 1039 for non-road engines. These regulations include requiring a maximum sulfur content in diesel fuel of 15 ppm. Additionally, it is expected that all vehicles would be properly maintained, which would also reduce emissions.

There are typically no operational emissions from the transmission lines and associated electrical equipment. If some electrical equipment contains the GHG sulfur hexafluoride gas (e.g., electrical switchgear, circuit breakers), there could be minor leaks, mostly associated with maintenance or long-term equipment degradation. However, their emissions are expected to be minimal or negligible. The expectation is that minimal equipment is anticipated to contain sulfur hexafluoride and the quantities should be very small. In addition, due to newer equipment, more efficient operation and maintenance techniques, and leak detection, these features would minimize sulfur hexafluoride emissions.

Overall, these transmission line construction and upgrade activities are expected to have short-term, minimal effects on air quality and no appreciable direct or indirect effect on regional climate change. Construction emissions are expected to occur in attainment areas across the Middle Tennessee area where current ambient levels of criteria pollutants are below ambient air quality standards and are not expected to appreciably change due to construction activities. The operation of the solar and battery storage transmission lines and associated equipment does not generate any continuous emissions. Their operation is expected to have long-term, minimal, or negligible effects on air quality and no appreciable direct or indirect effect on regional climate change.

3.7.2.5.3. Summary of Alternative C

The construction of multiple solar (assuming thirty 100 MW sites) and battery storage systems over large areas of middle Tennessee is expected to have short-term, localized, and minor effects on air quality. This construction is expected to have short-term, regional, and minor effects from GHG emissions on climate change. The operation of the solar/battery storage systems is expected to have long-term, moderate, beneficial effects on local air quality and reductions in future regional GHG emissions are expected to have long-term, moderate, beneficial effects on climate change in comparison to the No Action Alternative.

For Alternative C, the social cost benefit from CO_2 operational emissions reductions is estimated to be between $73.5 million and $646 million dollars the first year of operation, in nominal dollars, and would increase every year thereafter. On an individual replacement resource basis, the estimated total Alternative C life cycle social costs of GHG emissions ranges from approximately $135 million to $1.6 billion in nominal dollars. These values equate to between approximately $88 million and $1.1 billion in NPV to 2021 dollars. On a TVA system-wide basis, the estimated total Alternative C life cycle social costs of GHG emissions in comparison to the No Action Alternative, i.e., net savings/benefit, ranges from approximately $1.2 billion to $13.3 billion in nominal dollars. These savings/benefit values equate to between approximately $436 million and $4.8 billion in NPV to 2021 dollars.[21] In comparison to Alternatives A and B on an individual replacement resource basis, Alternative C has the lowest GHG life cycle emissions and associated estimated future social costs in nominal dollars. However, the NPV of Alternative C to 2021 dollars is larger than the Alternative B NPV because the majority of Alternative C GHG social costs are estimated to occur prior to its operation. This same comparison on a TVA system-wide basis results in Alternative C with the highest total life cycle social cost savings/benefit in comparison to the No Action Alternative.

3.7.2.5.4. Environmental Justice Considerations

Operation of the solar and storage facilities is not expected to produce any appreciable emissions and would therefore have minimal to negligible effects on air quality. The main effects

[21] A range of social costs is provided to account for using prior administration SC values and Biden Administration SC values.

of consideration for EJ populations would likely result from construction activities, operations, and considerations of greenhouse gases and climate change. Solar and storage facility construction activities are expected to have short-term, localized, and minor effects on air quality and no appreciable direct or indirect effect on regional climate change. Additionally, the solar and storage facility operations are expected to have long-term, moderate, beneficial effects on air quality and on regional climate change in comparison to existing conditions and are more favorable than Alternatives A or B. Full EJ considerations would be made for each solar and storage facility associated with Alternative C as it is proposed.

3.7.2.6. TVA System-Wide GHG LCA and Comparison Relative to Action Alternatives

3.7.2.6.1. TVA System-Wide Production Model

An analysis for the entire TVA-wide power system was performed using industry standard capacity planning and production cost models, ABB's System Optimizer and Energy Exemplar's Aurora. The capacity planning model develops a least-cost portfolio to meet demand and reserve margin while the production cost model simulates economic dispatch of the plan. The output includes an estimate of anticipated future emissions across the entire TVA system for each year.

Model results represent TVA's current forecast for electric load, asset performance, and commodity prices, among other things. Differences in any of these forecasts could result in higher or lower anticipated carbon emissions. Model results also represent TVA's commitment to reliably meet electric load at the lowest possible dispatch cost (in alignment with Section 113 of the Energy Policy Act of 1992), currently without a penalty applied to unit carbon emissions. Future regulatory requirements or incentives would likely result in lower emissions than these estimates, depending on those requirements and TVA's fleet composition at the time. The differences between each alternative are specific to the decision to retire or not retire Cumberland Fossil Plant and the associated replacement generation outlined in each alternative. Each alternative has subsequent impacts for other decisions in the future. Given this, there will be variations in simulated dispatch, which will result in differences in emissions, driven by the dynamic nature of power system modeling. The additional natural gas-fired generating capacity included in Alternatives A and B would not preclude higher levels of solar additions above and beyond the currently planned 10,000 MW by 2035. A regulatory environment that places limits on carbon emissions, or carbon-emitting generation, is likely to make renewable resources more economically viable over the long term, even if higher volumes of renewable resources result in temporary curtailments of wind or solar resources (i.e., reduction of power output below what the resource could have otherwise produced) to maintain reliability during periods of low electric load. However, the need for firm, dispatchable generation, such as natural gas-fired generation, to backfill intermittent renewable resources will remain.

3.7.2.6.2. TVA System-Wide GHG LCA and SC-GHGs

Similar to the manner in which the SC-GHG analysis is presented for an individual replacement resource by alternative basis, it is more thorough to prepare a TVA system-wide life cycle analysis view. The system-wide view provides critical context to how the specific resource retirements and replacements, underpinning the assumptions of each of the proposed Action Alternatives, integrates into the system overall. Developing a TVA system-wide life cycle analysis reflects TVA's broader asset strategy and target power supply mix set by the 2019 IRP. A TVA system-wide comparison of emissions is the most effective way to accurately identify

incremental emission differences between the alternatives because it illustrates how the entire TVA system is expected to operate with each alternative.

The replacement generation assets proposed in each of the action alternatives serve fundamentally different roles in the context of the larger TVA system in cost-effectively meeting electric load requirements. The combined cycle plant proposed in Alternative A would become one of the most fuel efficient CC plants in the TVA system and, as such, is likely to be dispatched frequently in baseload or intermediate operations in the near term to reduce total system costs for TVA ratepayers. The simple cycle combustion turbine plants in Alternative B would be some of the most efficient peaking units in the TVA system; however, they would almost always be dispatched after all existing CC and coal units for peaking operations, which refers to units only used for more limited durations during periods of high electric load. Given these differences in operation, a straight comparison of CC plant and CT plant emissions would erroneously lead to the conclusion that Alternative B results in lower overall carbon emissions if consideration is not given to the fact that the proposed CC plant makes the overall TVA system more fuel efficient. Similarly, the solar and storage proposed in Alternative C would generate and dispatch in yet another, completely different manner. The solar resources are intermittent in nature and only available during daylight hours. While the battery storage is fully dispatchable, it is energy limited (i.e., only able to store up to four hours per day of energy at full output). TVA would seek to optimize the use of these solar and storage resources; however, there would be some hours of operation where neither of these resources is available and therefore TVA would be forced to rely on the existing fleet of coal and gas units to meet generation needs. Only a full system-wide comparison of the alternatives will accurately account for these differences.

The results of the system-wide life cycle analysis for each alternative are presented in Table 3.7-12 and Table 3.7-13 below. Each action alternative is compared against the No Action Alternative in portraying the social cost of greenhouse gas emissions – CO2, CH4, and N2O. The costs are presented utilizing both the Biden Administration 2020 SCC rate of $51 per metric ton at a 3 percent discount rate (addressing global effects) and the prior administration's 2020 SCC rate of $7 per metric ton at a 3 percent discount rate (addressing domestic effects) to provide an illustration of the uncertainty that exists in these costs. Compared to the No Action Alternative, Alternative C generates the most cost savings followed by Alternative A, then Alternative B. On an NPV basis, presented in 2021 dollars, the analysis reflects about $4.8 billion of savings for Alternative C relative to the No Action Alternative. Alternative A reflects about $4.4 billion of savings relative to the No Action Alternative, and about $330 million less savings than Alternative C. Alternative B reflects about $3.9 billion of savings relative to the No Action Alternative, about $900 million and $590 million less savings than Alternative C and Alternative A, respectively. CO_2 is the most impactful greenhouse gas in the analysis representing about 95% of total cost savings presented by each action alternative compared to the no action alternative. Notwithstanding the lower savings from Alternative C as compared to Alternative A, other considerations, such as project costs which include capital, fuel, transmission and production costs, as well as the need to have firm, dispatchable power in place by 2026 when the first Cumberland unit is retired, would still lead TVA to identify Alternative A as the preferred alternative. More details regarding the TVA system-wide GHG LCA with emissions and associated social cost calculations are provided in Appendix I.

Table 3.7-12. TVA System-Wide Estimated Social Cost of Life Cycle GHG Emissions for Action Alternatives Compared to the No Action Alternative, by Life Cycle Phase (Biden)

Proposed Action Alternatives	One-Time Upstream (Nominal $)	Ongoing Combustion (Nominal $)	Ongoing Non-Combustion (Nominal $)	Methane Leakage (Nominal $)	One-Time Downstream (Nominal $)	Total (Nominal $)	NPV (2021 $)
Alternative A							
CO2	840,414,483	(12,697,868,888)	408,465,812	NA	802,526	(11,448,186,067)	(4,267,500,566)
CH4	1,224	11	(162,002,783)	806	107	(162,000,636)	(59,564,383)
N2O	133	(36)	(330,819,345)	NA	0	(330,819,248)	(122,244,047)
Alternative A Total	**840,415,840**	**(12,697,868,913)**	**(84,356,316)**	**806**	**802,632**	**(11,941,005,950)**	**(4,449,308,996)**
Alternative B							
CO2	365,425	(11,181,511,584)	1,217,967,896	NA	23,351	(9,963,154,911)	(3,688,176,474)
CH4	42	10	(158,472,409)	878	3	(158,471,476)	(57,632,610)
N2O	5	(38)	(323,449,682)	NA	0	(323,449,715)	(118,190,865)
Alternative B Total	**365,471**	**(11,181,511,612)**	**736,045,805**	**878**	**23,354**	**(10,445,076,103)**	**(3,863,999,949)**
Alternative C							
CO2	829,284,390	(14,479,093,167)	706,500,635	NA	101,883,394	(12,841,424,749)	(4,598,965,759)
CH4	94,286	4	(161,453,920)	546	36,434	(161,322,649)	(58,996,039)
N2O	10,254	(64)	(328,384,852)	NA	1,001	(328,373,661)	(120,686,463)
Alternative C Total	**829,388,929**	**(14,479,093,227)**	**216,661,863**	**546**	**101,920,830**	**(13,331,121,059)**	**(4,778,648,261)**

Table 3.7-13. TVA System-Wide Estimated Social Cost of Life Cycle GHG Emissions for Action Alternatives Compared to the No Action Alternative, by Life Cycle Phase (Prior Administration)

Proposed Action Alternatives	One-Time Upstream (Nominal $)	Ongoing Combustion (Nominal $)	Ongoing Non-Combustion (Nominal $)	Methane Leakage (Nominal $)	One-Time Downstream (Nominal $)	Total (Nominal $)	NPV (2021 $)
Alternative A							
CO2	1,293,613	(1,168,887,271)	114,072,562	NA	55,441	(1,053,465,655)	(403,144,217)
CH4	132	1	(14,208,849)	71	6	(14,208,640)	(5,364,757)
N2O	13	(3)	(24,054,600)	NA	0	(24,054,590)	(9,179,479)
Alternative A Total	**1,293,758**	**(1,168,887,272)**	**75,809,113**	**71**	**55,447**	**(1,091,728,884)**	**(417,688,452)**
Alternative B							
CO2	43,914	(1,027,028,763)	111,505,266	NA	1,613	(915,477,970)	(347,415,882)
CH4	4	1	(13,853,682)	76	0	(13,853,600)	(5,168,655)
N2O	0	(3)	(23,418,288)	NA	0	(23,418,290)	(8,825,692)
Alternative B Total	**43,919**	**(1,027,028,764)**	**74,233,296**	**76**	**1,613**	**(952,749,860)**	**(361,410,229)**
Alternative C							
CO2	99,656,869	(1,335,434,809)	64,027,933	NA	11,964,811	(1,159,785,196)	(421,438,970)
CH4	10,177	0	(14,138,712)	47	2,053	(14,126,435)	(5,302,767)
N2O	982	(5)	(23,827,906)	NA	96	(23,826,833)	(9,039,876)
Alternative C Total	**99,668,028**	**(1,335,434,813)**	**26,061,315**	**47**	**11,966,959**	**(1,197,738,464)**	**(435,781,614)**

3.8. Biological Environment

3.8.1. Vegetation

Vegetation in the form of young or mature trees, shrubs, vines, and herbaceous cover provides habitat and food resources for birds, mammals, reptiles, amphibians, and insects. Vegetation supports soil and nutrient cycles and provides ecosystem services, such as food, fresh water, fuel, fiber, and medicines to human populations (MSU, n.d.). Vegetative communities can help control flooding, disease outbreaks, pests, and climate effects, as well as serve as an important cultural role to Native American communities.

The federal Plant Protection Act of 2000 consolidated previous legislation and authorized the U.S. Department of Agriculture (USDA) to issue regulations to prevent the introduction and movement of identified plant pests and noxious weeds. EO 13112—Invasive Species directs federal agencies to prevent the introduction of invasive species (both plants and animals), control their populations, restore invaded ecosystems, and take other related actions. EO 13751—Safeguarding the Nation from the Effects of Invasive Species amends EO 13112 and directs actions to continue coordinated federal prevention and control efforts related to invasive species. Agencies are also directed to incorporate consideration of human and environmental health, climate change, technological innovation, and other emerging priorities into their efforts to address invasive species (USDA 2018a).

3.8.1.1. Affected Environment

CUF and surrounding areas are located within the Western Highland Rim, a subregion of the Interior Plateau Ecoregion. This region is characterized by rolling hills with a geologic base of limestone, chert, and shale. The original oak-hickory forests were mostly removed in the 1800s and early 1900s to produce charcoal for iron-ore smelting; however, the region is once again heavily forested (Griffith et al. 1997).

TVA surveyed terrestrial plant communities on the CUF Reservation in September 2021 (TVA 2021g) (Figure 3.8-1). Approximately 59 percent of CUF is vegetated. Of the vegetated areas, the most common community consists of deciduous forests (61.6 percent) or disturbed (formerly agricultural) fields (26.1 percent). The remaining 7.2 percent of the site consists of mixed evergreen forest, open areas, manicured or landscaped areas, or existing ROW. A majority of these forests have experienced extensive previous disturbance and are degraded by non-native species infestations. A small percentage of deciduous forested stands represent mature, relatively undisturbed plant communities populated primarily by native species. Developed areas with landscaped or manicured vegetation, pastures/hayfields, and transmission line ROWs account for a majority of the herbaceous vegetation, which is often dominated by non-native plant species and possesses little conservation value. Small sections of transmission line ROW support a flora indicative of a native grassland and support a number of native species.

Common overstory trees within deciduous forests on CUF Reservation include American beech, black cherry, northern red oak, pignut hickory, sassafras, shagbark hickory, slippery elm, southern red oak, sugar maple, tulip poplar, white ash, and white oak with an understory of American hophornbeam, common greenbrier, coralberry, eastern redbud, flowering dogwood, northern spicebush, pawpaw, Virginia creeper, and winged elm (TVA 2021g). Broad beechfern, spotted wintergreen, Christmas fern, ebony spleenwort, Indian tobacco, Japanese stiltgrass, licorice bedstraw, and wild comfrey are common in the herb layer. Species identified in the deciduous forests vary depending on whether the area is drier or mesic. Mesic or bottomland deciduous forests constitute 16.8 percent of the deciduous forest on site. Common species in these areas include American sycamore, green ash, southern hackberry, swamp chestnut oak,

sweetgum, bald cypress, black willow, box elder, red maple, Osage orange, sugar maple, white oak, Carolina buckthorn, Chinese privet, American beech, black walnut, grape, and poison ivy.

The disturbed fields support a majority of herbaceous vegetation present on site (TVA 2021g). Common species in these areas include Johnson grass and sericea lespedeza along with other common native and non-native herbaceous species. Early successional communities in in the TL ROWs also include herbaceous vegetation consisting primarily of annual ragweed, beefsteak plant, brown eyed Susan, late-flowering thoroughwort, gray goldenrod, purple passionflower, sawtooth blackberry, sericea lespedeza, wild bergamot, and wrinkle leaf goldenrod.

Further details of the various plant communities found on the CUF Reservation is provided in the Terrestrial Plant Communities and Botanical Resources Survey Report attached as Appendix J.

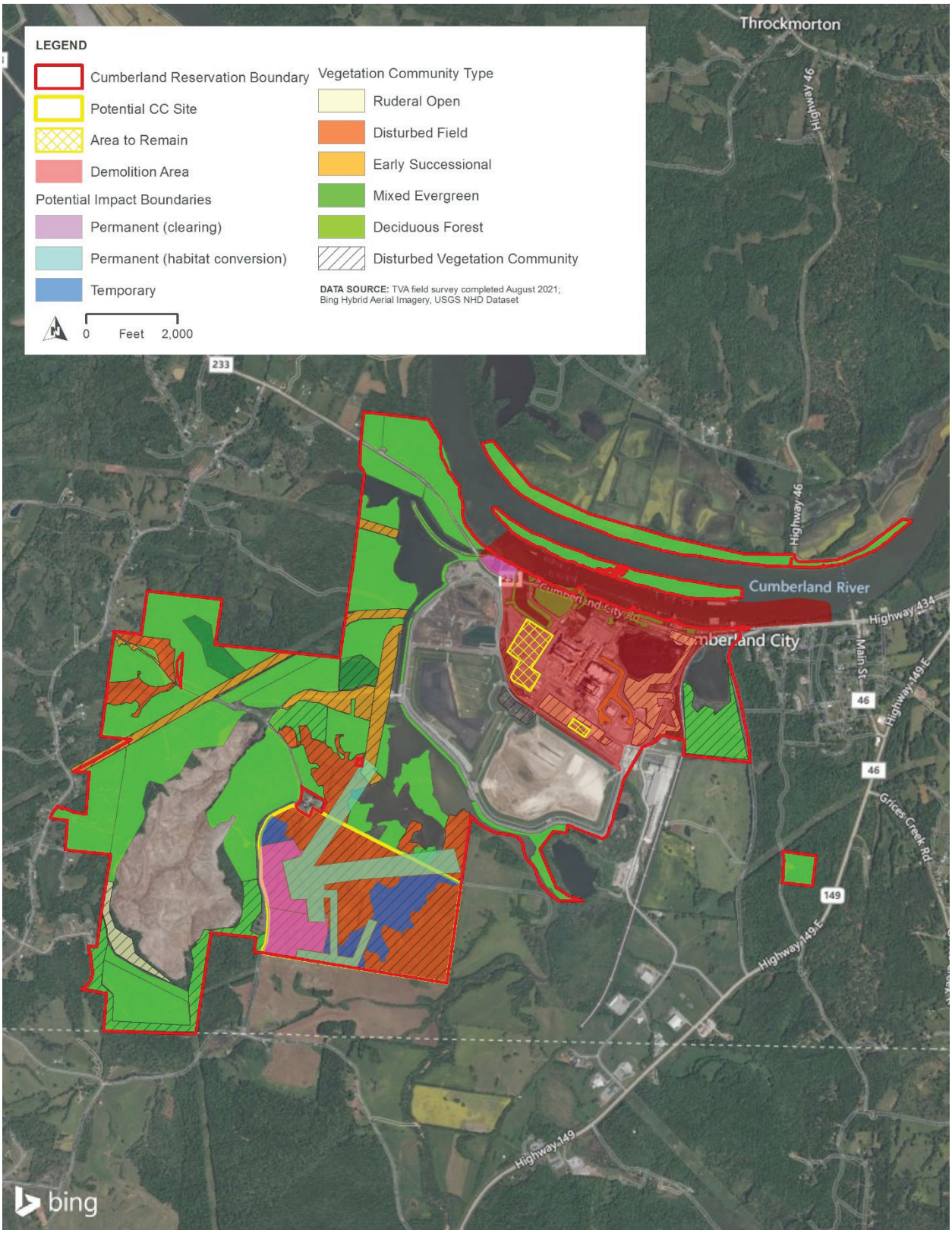

Figure 3.8-1. Vegetation Communities Observed on the Cumberland Reservation

3.8.1.1.1. Alternative A

3.8.1.1.1.1. Proposed CC Plant

Based on the survey completed in September 2021, the site for the proposed CC plant consists almost entirely of disturbed field with common species such as Johnson grass, sericea lespedeza, and other common native and non-native herbaceous species (TVA 2021g) (Figure 3.8-1). Thickets of honey locust and fragmented forest strips supporting species seen in other deciduous forest stands on site are present across this area. The wetland complexes (approximately 29.4 acres total) on the site (see Section 3.6.3.1.2) are primarily herbaceous habitats with *Carex* spp., redtop panicgrass, tickseed sunflower, calico aster, virgin's bower, Virginia wildrye, and Japanese stiltgrass. Forested wetlands have tree or sapling stratums with American sycamore, American elm, swamp chestnut oak, pin oak, ash-leaf maple, common pawpaw, green ash, black willow, and honey locust.

3.8.1.1.1.2. Natural Gas Pipeline Corridor

Information regarding vegetation types in and adjacent to the pipeline corridor was obtained from aerial photography review, existing land use classifications, and environmental field surveys completed between June 2021 and January 2022 (TGP 2022c). The pipeline corridor and surrounding areas are located within the Western Highland Rim, a subregion of the Interior Plateau Ecoregion. The corridor area is predominantly rural with vegetative cover types primarily composed of forested communities and cultivated agricultural land/pastureland. Vegetative habitats observed during field surveys were classified by the presence of the dominant vegetation types consisting of upland forest and upland herbaceous vegetative communities.

Upland forested areas are dominated by trees greater than three inches in diameter at breast height and greater than 20 feet in height (TGP 2022c). The upland forest land cover within the pipeline corridor is "dominated by a mixed hardwood canopy. Common tree species [identified] include green ash, American sycamore, box elder, sweetgum, tulip poplar, southern red oak, white oak, American beech, sweetgum, tulip polar, pignut hickory, hornbeam/ironwood, and loblolly pine. Common shrubs in this habitat include buckeye, winged sumac, witch hazel, and Chinese privet. Common herbs and vines include blackberry, Japanese honeysuckle, Virginia creeper, and greenbrier" (TGP 2022c).

Upland herbaceous land consists of areas of grassland and shrubland, including utility ROWs, which are dominated by various grasses, shrubs, and/or tree saplings. The upland scrub/upland herbaceous habitat in the open land cover of the pipeline corridor includes pasture and other non-forested, vegetated areas, primarily consisting of utility ROWs and a small number of fallow crop fields (TGP 2022c). Species observed in these habitats include "high bush blackberry, flat-top goldenrod, broom sedge, tickseed, Bermuda grass, dog fennel, bluestem, ragweed, and goldenrod. Early successional shrubs, such as blackberry and Japanese honeysuckle, and scattered pine and hardwood seedlings and saplings" were also observed (TGP 2022c).

The dominant vegetation observed in the PFO wetlands consists of woody vegetation that is at least 20 ft tall, including "American sycamore, box elder, red maple, sweetgum, tulip poplar, blackgum/black tupelo, and loblolly pines. […] The PEM wetlands were dominated by herbaceous vegetation, typically with little shrub component present, […] including bluestem, soft rush, beaksedge, blackberry, goldenrod, dog fennel, and native cane" (TGP 2022c). See Section 3.6.3 for a more detailed description of wetlands.

Open water areas include ponds, streams, and rivers crossed by the pipeline. These areas do not support significant amounts of vegetation. Developed areas, such as roads, parking lots, and other disturbed areas, also do not support vegetation (TGP 2022c).

Vegetation communities are often susceptible to succession of invasive plant species following ground disturbance from construction, typically in areas of prior surface disturbance like agricultural areas, roadsides, existing utility ROWs, and areas of high wildlife concentration (TGP 2022c). Thirty-five invasive plants of concern in Tennessee potentially occur in or near the pipeline corridor (Table 3.8-1). Sporadic concentrations of noxious weeds observed during field surveys included Chinese privet and Japanese honeysuckle. Occurrences of these invasive species were primarily at roadsides and areas previously disturbed by agricultural equipment.

Table 3.8-1. Tennessee State-Listed Invasive Plants Potentially Occurring in or near the Pipeline Corridor

Common Name	Scientific Name
Mimosa	*Albizia julibrissin*
Garlic mustard	*Alliaria petiolata*
Hairy mointgrass	*Arthraxon hispidus*
Smooth brome	*Bromus inermis*
Asian bittersweet	*Celastrus orbiculatus*
Spotted knapweed	*Centaurea stobe*
Sweet autumn clematis	*Clematis terniflora*
Chinese yam	*Dioscorea polystachya*
Autumn olive	*Elaeagnus umbellata*
Burning bush	*Euonymus alatas*
Winter creeper	*Euonymus hederaceus*
Japanese knotweed	*Fallopia japonica*
English ivy	*Hedera helix*
Bicolor lespedeza	*Lespedeza bicolor*
Chinese lespedeza	*Lespedeza cuneata*
Chinese privet[1]	*Ligustrum sinense*
Japanese honeysuckle	*Lonicera japonica*
Bush honeysuckle	*Lonicera maackii*
Purple loosestrife	*Lythrum salicaria*
Japanese stilt grass	*Microstegium vimineum*
Chinese silvergrass	*Miscanthus sinensis*
Marsh dayflower	*Murdannia keisak*
Empress tree	*Paulownia tomentosa*
Beefsteak plant	*Perilla frutescens*
Common reed	*Phragmites australis*
Kudzu[1]	*Pueraria montana var. lobata*
Callery pear	*Pyrus calleryana*
Multiflora rose	*Rosa multiflora*

Common Name	Scientific Name
Wineberry	*Rubus phoenicolasius*
Johnson grass	*Sorghum halepense*
Japanese spiraea	*Spiraea japonica*
Coltsfoot	*Tussilago farfara*
Japanese wisteria	*Wisteria floribunda*
Chinese wisteria	*Wisteria sinensis*
Common periwinkle	*Vinca minor*

Source: Tennessee Invasive Plant Council 2017 List Revision in TGP (2022c)
[1]Observed during field surveys.

3.8.1.1.1.3. Transmission Corridors

The TL corridors associated with the proposed CC plant consist of disturbed field (86.5 acres), deciduous forest (3.19 acres), and early successional habitat (2.32 acres). Deciduous forest in these corridors are primarily bottomland forest, but drier areas are also present. As described in Section 3.8.2.1.1, the tree species in the bottomland forests include American sycamore, green ash, bald cypress, southern hackberry, swamp chestnut oak, sweetgum, black willow, box elder, and red maple. Drier deciduous forests exhibit other common species, such as white oak, blackjack oak, southern red oak, sugar maple, shagbark hickory, American beech, chinkapin oak, mockernut hickory, northern red oak, tulip poplar, white ash, pawpaw, honey locust, sassafras, and spicebush.

3.8.1.1.2. Alternative B

3.8.1.1.2.1. Johnsonville Reservation

Like the CUF Reservation, the JCT Reservation is in the Western Highland Rim, a subregion of the Interior Plateau Ecoregion characterized by rolling hills and oak-hickory dominated forests (Griffith et al. 1997).

A large proportion of the JCT Reservation site has been heavily disturbed by the construction, operation, and maintenance of the generation and transmission infrastructure present there. Land use on the JCT Reservation is almost entirely classified as medium- or high-intensity developed space (Figure 3.10-5). Most of the CT site has been heavily disturbed and exhibits herbaceous vegetation dominated by non-native plant species with little conservation value.

3.8.1.1.2.2. Gleason Reservation

The Gleason Reservation is in the Southeastern Plains and Hills, a subdivision of the Southeastern Plains Ecoregion (Griffith et al. 1997). This ecoregion is comprised of irregular plains made up of a mosaic of cropland, pasture, woodland, and oak-hickory-pine forest.

Based on the NLCD, the Gleason Reservation is 62.1 percent cultivated crops (former agricultural fields) and 32.9 percent woody wetlands (the forested area on the southern half of the site), with small amounts of developed and mixed forest areas. Although the NLCD identified woody wetlands (see Figure 3.10-7 in Section 3.10.2.3.2), the NWI identified only a single stream on site and no palustrine wetlands present (Figure 3.5-1).

Based on 2008 field visits to areas on or near the Gleason Reservation, the cultivated crop areas consist of weedy, early successional and ruderal vegetation types typical of abandoned agricultural fields, such as Bahai grass, broomsedge, crabgrass, Dallas grass, purple sprangle top, redtop panic grass, and signal grass. The forested area on the plant site appears to be

comprised of deciduous species based on aerial imagery and according to field investigations on or nearby the site in 2008, the forested area likely contains an oak-hickory community comprising American beech, black oak, shagbark hickory, southern red oak, and white oak overstory with an open understory with deciduous holly, persimmon, and red maple.

Invasive plants, which are a major threat to native plant communities, have affected much of the Gleason Reservation. The lands on and adjacent to the reservation have been extensively altered as a result of previous land-use history. The most common invasive species encountered were Chinese privet and Japanese honeysuckle along with several non-native grasses and common weedy herbaceous species. Based on information from the Tennessee Invasive Plant Council, the threat level for both Chinese privet and Japanese honeysuckle is considered Established (TNIPC 2022). Established Threats include taxa that have been found in more than 10 counties and cannot be eradicated on a landscape scale using methods currently available.

3.8.1.1.2.3. Transmission Corridors

The TL corridor for Alternative B crosses the Loess Plains (a subdivision of the Mississippi Valley Loess Plains) on the western portion; the Southeastern Plains and Hills (a subdivision of the Southeastern Plains Ecoregion) in the center of the corridor; and Western Highland Rim (a subdivision of the Interior Plateau) on the eastern edge (Griffith et al. 1997). It has the potential to cross a range of plant communities, including highly disturbed, early successional habitats dominated by invasive species, to rich and diverse herbaceous plant communities with possible landscape-level conservation importance. The Loess Plains are characterized by gently rolling, irregular plains with productive agricultural practices of soybeans, cotton, corn, milo, sorghum, livestock, and poultry. Oak-hickory and southern floodplain forests are the natural community types, however much of this have been removed for cropland. Some less-disturbed bottomland forest and cypress-gum swamp habitats remain. The Southeastern Plains and Hills have slightly more rolling topography and relief than the Loess Plains, with oak-hickory forests grading into oak-hickory-pine forests toward the south. As stated for CUF Reservation and JCT Reservation, the Western Highland Rim is rolling terrain of open hills with oak-hickory forests. Some agricultural use occurs in lower-gradient areas and valleys consisting of hay, pasture, cattle, corn, and tobacco.

Oak-hickory forests are generally composed of broadleaf deciduous trees of which white oak, northern red oak, black oak, shagbark hickory, and bitternut hickory dominate. Additional vegetation species in this community type include pignut hickory, white ash, black walnut, black cherry, chinquapin oak, American basswood, and American elm (Bryant et al. 1993). Oak-hickory-pine forests are similar to oak-hickory forests, except for the addition of shortleaf and loblolly pines. Floodplain forests exhibit similar species as oak-hickory in the region, but also contain swamp chestnut oak, cherrybark oak, pin oak, Shumard oak, shellbark hickory, shagbark hickory, and sweetgum. Understory species in these forests include more shade-tolerant species, such as maples, blackgum, elm, American beech, and dogwood (Applegate et al. 1995).

The majority of herbaceous vegetation habitat types occur along existing transmission line ROWs, cropland, hayfields, and heavily grazed pastures. Most sites with herbaceous plant communities are dominated by plants indicative of early successional habitats including many non-native species. Early successional areas with naturalized vegetation contain herbaceous species like anise-scented goldenrod, beaked panic grass, broomsedge, field thistle, giant ironweed, gray goldenrod, hairy lespedeza, hairy small-leaf tick trefoil, hairy sunflower, hyssopleaf thoroughwort, Japanese honeysuckle, Japanese stiltgrass, Johnson grass, late

purple aster, maypops, narrowleaf mountain mint, purpletop tridens, rabbit tobacco, red fescue, rice button aster, sawtooth blackberry, sericea lespedeza, silver beard grass, silver plume grass, swamp sunflower, tall goldenrod, trumpetweed, velvet panicum, whorled mountain mint, and yellow bristle grass.

3.8.1.1.3. Alternative C

3.8.1.1.3.1. Middle Tennessee TVA Power Service Area

The Middle Tennessee TVA Power Service Area primarily lies within the Interior Plateau Ecoregion, further subdivided by the Western Highland Rim, Eastern Highland Rim, Outer Nashville Basin, and Inner Nashville Basin (Griffith et al. 1997). The Interior Plateau is a diverse ecoregion with natural vegetation, primarily oak-hickory forest, with some areas of bluestem prairie and cedar glades. As described in Section 3.8.1.1.2.3, the Western Highland Rim is characterized by rolling terrain of open hills and oak-hickory forests. The Eastern Highland Rim has more level terrain than the Western Highland Rim, with landforms characterized as “tablelands” of moderate relief and irregular plains. Natural vegetation in this region is transitional between the oak-hickory type to the west and the mixed mesophytic forests to the east. Many bottomland hardwood forests that were formerly abundant have been inundated by large impoundments.

The major forest communities in the Middle Tennessee TVA region include mesophytic forest and southern-mixed forest (Dyer 2006). The mesophytic forest is the most diverse, with 162 tree species. While canopy dominance is shared by several species, red maple and white oak have the highest average importance values. A distinct section of the mesophytic forest, the Appalachian oak section, is dominated by several species of oak, including black, chestnut, northern red, scarlet and white oaks. The bottomland forests in this region are dominated by American elm, bald cypress, green ash, sugarberry and sweetgum.

The Nashville Basin contains limestone cedar glades and barrens communities associated with thin soils and limestone outcrops that support rare, diverse plant communities with a high proportion of endemic (i.e., restricted to a particular area) species (Baskin and Baskin 2003). About 38 percent of the ecoregion is forested, 50 percent is agricultural and 9 percent developed (USGS 2016). Forests in the Nashville Basin are predominantly mesophytic, with a higher proportion of American beech, American basswood, and sugar maple than in the Appalachian oak subtype (Dyer 2006). Eastern red cedar is also common. For the ecoregion as a whole, the rate of land cover change has been relatively low, with the predominant changes from forest and agriculture to developed land. The rate of these changes from the 1970s to the present has been very high in the greater Nashville and Huntsville areas.

Several rare (or otherwise geographically restricted or threatened by human activities) plant communities are found in the Middle Tennessee TVA PSA. The greatest concentration of cedar glades is in the Nashville Basin; a few also occur in the Highland Rim and the Valley and Ridge. Cedar glades contain many endemic plant species, including a few listed as endangered (Baskin and Baskin 2003); threats include urban development, highway construction, agricultural activities, reservoir impoundment, and incompatible recreational use. The category of grasslands, prairies, and barrens includes remnant native prairies; they are scattered across the TVA region but are most common on the Highland Rim.

Heavily disturbed pasturelands account for a majority of herbaceous vegetation present in Middle Tennessee. Vegetation includes Johnson grass, sericea lespedeza, and other common native and non-native herbaceous species.

3.8.1.2. Environmental Consequences

3.8.1.2.1. The No Action Alternative

Under the No Action Alternative, TVA would continue current plant operations. TVA would implement all of the planned actions related to the current and future management and storage of CCRs, which have either been reviewed or will be reviewed in NEPA analyses. As a result, no new work would be conducted that could potentially alter project-related environmental conditions in the vicinity of the CUF plant. Therefore, there would be no direct or indirect effects to vegetation communities because there would be no physical changes to the current conditions.

3.8.1.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Vegetation within the demolition boundary consists primarily of ruderal open areas and small portions of deciduous forest (Figure 3.8-1). Ruderal habitat provides little benefit to wildlife in the vicinity of the CUF Plant, however the areas with trees may provide some habitat for common wildlife.

Demolition of on-site buildings and structures would involve demolition to three feet below final grade via mechanical deconstruction and/or explosives. All buildings and structures with below grade features would be backfilled. Vegetation may colonize areas with sufficient soil following deconstruction and removal of the existing facility and would likely comprise similar species to those currently observed in ruderal open areas. No cumulative effects to vegetation are anticipated.

3.8.1.2.3. Alternative A

3.8.1.2.3.1. Construction and Operation of CC Plant at CUF Plant Site

Construction of the CC plant and related facilities (construction laydown area, construction support area, and switchyard) would impact 96.5 acres of disturbed field habitat comprising common and weedy herbaceous species. Effects to vegetation would generally result from earthmoving and vegetation clearing activities associated with the construction of the proposed project. To prevent the introduction and spread of invasive species, disturbed areas on all action alternatives will be revegetated with native or non-invasive plant species.

The construction of up to four short 500-kV transmission lines from the switchyard to the new CC plant would affect an approximately 88.8 acres of disturbed field and early successional habitat and about 3.2 acres of deciduous forest, most of which would be cleared.

Impacts to vegetation are assessed by TVA each year in accordance with NEPA (TVA 2020a); the following section provides an assessment of project specific effects anticipated under Alternative A. Vegetation within the active transmission ROW would have to be managed to assure the safe and reliable operation of the transmission facilities (TVA 2020a). Generally, areas within the transmission line corridors would be maintained as scrub/shrub and herbaceous land. Typically, vegetation management activities consist of herbicide application (90 percent), mechanical control (i.e., brush hogs, equipment-mounted saws; 6 percent), and manual methods (i.e., chainsaw, handsaw; 4 percent) (TVA 2020a). Tree maintenance would be limited to trees that presented an immediate hazard to the reliability of the transmission system. Localized herbicide application and mowing are the vegetation management tools that would be used most frequently to clear vegetation on the floor of the open ROW. Other manual, mechanical, and herbicide application methods, along with debris management and restoration activities, are likely to occur infrequently and/or do not have the potential to affect vegetation on

a meaningful scale. Tree clearing along the ROW margins would result in a negligible overall change to plant habitats present on the landscape.

Cumulative effects to vegetation are not anticipated to result from the proposed CC plant and CCR management activities on the CUF Reservation, as these activities would mostly be in previously disturbed areas. Disturbed areas will be revegetated based on TVA's BMP Manual specifications and clearing and other vegetation management activities will be minimized to the extent possible (TVA 2017a).

3.8.1.2.3.2. Construction and Operation of Natural Gas Pipeline

Effects to vegetation would generally result from clearing the pipeline corridor. The pipeline is located directly adjacent to an existing TVA transmission line; therefore, the pipeline would have cumulative effects to vegetation along this corridor. Tree trimming, limb removal, or other modifications may be needed for existing access roads. TGP has prepared a detailed analyses of project effects to vegetation as part of the Environmental Report, which TVA draws from for this analysis.

The amount of each vegetation cover type that would be impacted by construction and operation of the pipeline are detailed in Table 3.8-2.

Table 3.8-2. Vegetation Type Affected by Construction and Operation of the Natural Gas Pipeline Corridor and Appurtenant Features[1]

Facility	Upland Forest		Upland Scrub		Upland Herbaceous	
	Const.	Oper.	Const.	Oper.	Const.	Oper.
Pipeline[2,3]	128.10	114.71	1.52	1.22	105.68	66.63
Pressure Regulator Station[2]	1.40	0.00	0.00	0.00	0.00	0.00
Contractor Yard	0.00	0.00	0.00	0.00	16.00	0.00
Access Roads[2]	16.82	0.00	0.08	0.00	14.27	0.00
Meter Station[2]	0.00	0.22	0.00	0.00	0.64	0.00
Project Total	**144.92**	**116.32**	**1.61**	**1.22**	**135.95**	**67.27**

Source: TGP 2022c
Const.: Construction; Oper.: Operation
[1] Numbers may vary slightly due to rounding.
[2] Construction area includes the total acres of workspace required for construction of the Project, including the operation area.
[3] The proposed Mainline Valve will be installed entirely within the proposed permanent, maintained right-of-way for the pipeline, and therefore will not result in additional acreage impacts.

As stated in TGP's Resource Report 3 (TGP 2022c):

> The primary impact of construction of [the pipeline] on vegetation would be the cutting, clearing, and/or removal of existing vegetation within the construction workspace and ATWS. Secondary effects associated with disturbances to vegetation may include increased soil erosion, increased potential for the introduction and establishment of invasive weed species, and a local reduction in available wildlife habitat. […] Large obstacles, such as trees, rocks, brush, and

> logs, would be removed. Timber would be removed only when necessary for construction purposes. Timber and other vegetative debris may be stacked at the edge of the ROW, chipped for use as erosion-control mulch, or otherwise disposed of in accordance with applicable regulations and landowner requirements/requests.
>
> The greatest impact of the pipeline on vegetation construction would be from the clearing of approximately 125 acres of forested areas. Forested areas cleared within the temporary construction workspace and ATWS, totaling about 13 acres, would be allowed to revert to preconstruction conditions; however, impacts on these communities will be long-term due to the time required for woody vegetation growth and recovery. Forested areas within the permanent ROW would undergo permanent conversion to an herbaceous or scrub-shrub cover type and re-establishment of trees within the permanent ROW generally is precluded. Maintenance functions within the permanent ROW would include periodic seasonal mowing and side-trimming and tree removal.
>
> Following construction, restoration and revegetation [would] be conducted in accordance with FERC Plan and FERC Procedures (with [approved] deviations). If construction is completed during the fall and winter months, a temporary seed mix would be applied to provide temporary vegetative cover until the spring planting season. […] TGP [would] implement measures in the FERC Upland Erosion Control, Revegetation, and Maintenance Plan, the FERC Wetland and Waterbody Construction and Mitigation Procedures and Noxious and Invasive weed Control Plan to minimize the potential to introduce or spread noxious or invasive species during construction and operation of the [pipeline]. TGP would also provide training for construction personnel working on the Project to minimize the introduction or spread of noxious or invasive species during construction and operation of the natural gas pipeline. Implementation of topsoil segregation in accordance with FERC Plan and FERC Procedures (with requested deviations) would facilitate post-construction revegetation success, thereby minimizing the potential for long-term erosion due to lack of vegetative cover.
>
> TGP does not intend to re-seed or re-plant disturbed wetland areas. TGP [would] rely on natural revegetation to occur and would monitor according to the FERC Procedures (with [approved] modifications). However, TGP would adhere to the USACE permit conditions for wetland restoration.

Temporary workspaces and ATWS would be allowed to return to pre-construction conditions. In accordance with the FERC Plan and FERC Procedures (with approved deviations) and expected USACE permit conditions and TDEC ARAP conditions, TGP would “monitor disturbed areas to determine the post-construction revegetation success. The revegetation monitoring also would assess whether invasive plant species are becoming established. Impacts on the open land cover type would be temporary and short-term. After restoration of the ROW, non-agricultural open land vegetation communities typically would regenerate quickly. Agricultural lands also would revert to pre-construction use” (TGP 2022c). Success criteria for post-construction revegetation will be defined through applicable stormwater construction permits or in USACE permit and TDEC ARAP conditions.

Cumulative impacts to vegetation could occur because of past, present and RFFAs in proximity to the pipeline. The cumulative impact assessment area for cumulative impacts on vegetation

includes lands within one mile of the natural gas pipeline corridor workspaces. Vegetation impacts resulting from construction of the pipeline "are expected to take the following forms: (1) direct temporary impacts from vegetation clearing during construction; and (2) indirect impacts, such as the spread of invasive species, from land disturbance activities […] Mitigation measures […] will mitigate construction-related impacts, including restoration of vegetated areas. With the implementation of these mitigation measures, cumulative impacts on vegetation resulting from construction are expected to be minor."

As stated in TGP's Resource Report 1 (TGP 2022a):

> TGP reviewed nearby past, present, and reasonably foreseeable future projects that occur within one mile of the [pipeline] area to determine the cumulative impact to vegetation resources within the CIAA. Nine projects are located within the CIAA. The TVA Cumberland Fossil Plant Retirement proposed alternative would be constructed entirely within disturbed field vegetation.

The proposed transmission corridor for the proposed alternative would impact approximately 186 acres of disturbed field and 68 acres of deciduous forest (TVA 2021b). The Management of Coal Combustion Residuals from the Cumberland Fossil Plant proposed alternative would impact approximately 41 acres of open water, 13 acres of developed land, 4 acres of PEM wetlands, and 0.1 acre of PFO wetlands (TVA 2018a). The Cumberland Fossil Plant Borrow Areas and Access Road would impact approximately 21 acres of deciduous forest, 1 acre of developed land, 91 acres of herbaceous vegetation, 0.6 acre of open water, 0.6 acre of woody wetlands, and 0.2 acre of emergent wetlands (TVA 2017b). The Cumberland Fossil Plant Wastewater Treatment Facility will impact only heavily disturbed areas (TVA 2019b). The Cumberland River Compact in Lieu-Fee Program does not have specific information on the vegetation impacts related to the program (USACE 2016). The Dickson Terminal Project does not have specific information on the vegetation impacts; however, the Project encompasses 35 acres and appears to be located on undeveloped property consisting of forested and herbaceous vegetation (Titan Partners 2022). The Economic Development-Canterbury Site would impact 19 acres of herbaceous vegetation and 9 acres of deciduous forests (TVA 2022b). The Magnum Manufacturing Expansion does not have specific information on the vegetation impacts; however, the Project area appears to encompass less than 10 acres (Tennessee Department of Economic and Community Development 2017). The Hayes Fork Wetland Mitigation Bank encompasses 19.6 acres of wetlands" (TGP 2022c).

[…] Although efforts have been made to minimize permanent tree clearing through co-location, loss of forested upland resulting from the Project would result in a cumulative impact on forested uplands" (TGP 2022c). TVA has evaluated and concurs with TGP's conclusions as presented in Resource Report 3 (TGP 2022c).

3.8.1.2.3.3. Summary of Alternative A

Between the Alternative A CC plant and natural gas pipeline, approximately 420 acres of temporary impacts and 237 acres of permanent impacts are estimated to vegetation communities (Table 3.8-3). Impacts are primarily to herbaceous and forested areas. Temporary impacts to herbaceous plant communities for either the CC plant or natural gas pipeline would be moderate but short-term impacts, as these areas would be reseeded with native seed and allowed to regenerate following completion of construction activities. Temporary impacts to forested areas due to construction of the natural gas pipeline would be a long-term impact due to the time necessary for woody vegetation growth and recolonization of these areas.

At the CC plant site, the majority (97.7 percent) of permanent impacts are to herbaceous plant communities (including early successional habitat, but mostly disturbed fields). However, herbaceous habitat within the TL ROWs (88.8 acres) may be temporarily disturbed during transmission line installation and a minor permanent impact at the sites of transmission towers (not yet sited); overall, disturbed and early successional habitat in these areas would quickly regenerate following disturbance. These areas are not high-value wildlife habitat but are used by common species. Permanent impacts proposed for the natural gas pipeline consists largely of both herbaceous (36.4 percent) and forested (62.9 percent) plant communities. Almost all (98.6 percent) permanent impacts from the natural gas pipeline to forested areas are the result of habitat conversion required through the natural gas pipeline corridor. While habitat in these areas will not be removed, the habitat type and wildlife utilizing them will change.

Overall, impacts to vegetation communities for Alternative A are significant, primarily associated with effects associated with the natural gas pipeline corridor.

Table 3.8-3. Summary of Alternative A Vegetation Community Impacts

Vegetation Community	CC Plant			Natural Gas Pipeline		Total
	Temporary (clearing)	Permanent (clearing)	Permanent (habitat conversion)	Temporary	Permanent	
Herbaceous[1]	137.2	48.1	--	136.0	67.3	**388.5**
Forest	--	0.3	3.2	144.9	116.3	**264.7**
Scrub/Shrub	--	--	--	1.6	1.2	**2.8**
Landscaped/ manicured	--	0.8	--	--	--	**0.8**
Total	**137.2**	**49.2**	**3.2**	**282.5**	**184.8**	**656.9**

[1]Includes disturbed field and early successional habitat

3.8.1.2.3.4. Environmental Justice Considerations

To the extent that it is practicable, feasible, and legally permitted, TGP would locate the natural gas pipeline generally parallel and adjacent to existing electric transmission lines owned and operated by TVA, which would generally minimize effects. However, EJ populations are prominent in the pipeline corridor (seven out of 10 census block groups are EJ populations; see also Figure 3.4-3). The greatest impact of the pipeline on vegetation construction would be from the clearing of approximately 128 acres of forested areas. In areas that are currently used by EJ populations, potentially including the forested areas, which would be revegetated with low-growing plants, there is potential for amplified effects to EJ populations. Effects to EJ populations regarding permanent conversion of farmland to maintained transmission line ROW is addressed in Section 3.5.1.2.3.4.

3.8.1.2.4. Alternative B

3.8.1.2.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

The proposed CT plants would be constructed on developed land on the Johnsonville Reservation. Vegetation may be impacted within the project boundary during the construction of the Johnsonville Reservation. The vegetation present in this area consists of disturbed herbaceous vegetation. To prevent the introduction and spread of invasive species, disturbed areas will be revegetated with native or non-invasive plant species. No cumulative effects to

vegetation are anticipated as the RFFA of the Aeroderivative plant would occur on developed portions of JCT.

3.8.1.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

The construction of CT plants at the Gleason Reservation would occur within the 62 acres of undeveloped land adjacent to the existing CT units. The CT plants would be configured to minimize effects to forested areas and would likely be sited within the existing agricultural fields. As such, no cumulative effects to vegetation are anticipated.

3.8.1.2.4.3. Transmission and Other Components

Impacts to vegetation are assessed by TVA each year in accordance with NEPA (TVA 2020a); the following section provides an assessment of project specific effects anticipated under Alternative B. As noted in Table 3.3-1, transmission lines typically result in an average of 5.5 acres of forest clearing per mile of new line, with a range of 0 to 30.5 acres/mile; for the proposed 40-mile transmission line, this equates to 220 acres of forest cleared (range 0 to 1,220 acres) and an average of 4.5 acres of forest cleared for substations and switching stations. Also based on typical effects, the transmission line has the potential to affect an average of 0.9 acre/line mile of forested wetlands cleared, for an average of 36 acres of forested wetlands cleared. Farmland falling within the transmission line corridor could be temporarily impacted, but areas such as pasture, agricultural fields, or lawns would be returned to their former condition following construction. These areas are often subject to herbicide methods for localized treatments of weeds by landowners, and farmland does not often contain many trees requiring control (TVA 2020a); therefore, effects to agricultural areas will be minimal. For the 40-mile TL, it can be estimated that 220 acres of forest will be cleared, resulting in a long-term effect to forest management (Table 3.3-1).

Vegetation within the active transmission ROW would be managed to assure the safe and reliable operation of the transmission facilities and generally maintained as scrub/shrub and herbaceous land. Vegetation management activities would likely consist primarily of herbicide application with mechanical control or manual methods as needed; other manual, mechanical, or herbicide application methods occur infrequently and do not have the potential to affect vegetation on a meaningful scale (TVA 2020a). Tree maintenance would be limited to trees that presented an immediate hazard to the reliability of the transmission system. Tree clearing along the ROW margins would result in a negligible overall change to plant habitats present on the landscape.

Localized applications of herbicide would result in some level of off-target effect (TVA 2020a). In situations where the woody stem count is high on a given ROW, even localized application of herbicides could produce substantial effects to non-target species. However, these areas of high woody stem count would be unlikely to support high-quality herbaceous habitats, usually because of site-specific conditions unrelated to TVA vegetation management (i.e., owner land use, soil type, landscape position, etc.). In drier transmission line ROW areas with rocky or sandy soils, where woody stem count is inherently lower, localized herbicide application could foster herbaceous plant communities that are rare on the landscape. These important plant habitats may be globally rare or just relatively diverse herbaceous communities, with limited distribution remaining in the southeastern U.S. Mowing would remove nearly all woody stems; however, the amount of re-growth can be rapid depending on conditions on the ground (TVA 2020a). For example, in drier areas with sandy or rocky soils, the rate of tree establishment and growth is relatively slow. In this case mowing can help to maintain high quality native plant communities. However, in all but the driest habitats in the eastern U.S., tree invasion is rapid, and woody plants quickly replace herbaceous species. In addition, repeated mowing of

transmission line ROW encourages stump resprouting (sucker growth) and promotes dense stands of woody species. This is particularly problematic in wetlands or on sites with rich soils. Using mowing alone, or as the primary mechanism for vegetation removal on ROWs, would reduce species diversity and encourage the dominance of woody plants able to proliferate through root resprouting.

TVA uses the Office-Level Sensitive Area Review (O-SAR) process to avoid effects to important plant habitats within ROWs by limiting the use of the most damaging methods in areas likely to contain grasslands dominated by native plant species (TVA 2020a). Broadcast and aerial herbicide is restricted on about 17 percent (about 41,000 acres) of TVA's ROW that are likely to contain important habitat. Manual, mechanical, and localized herbicide methods can be used in these areas and likely serve to perpetuate important herbaceous habitats found in the ROW by eliminating trees that rapidly encroach into open areas without appropriate disturbance. Rare plant habitat falling within the transmission line corridor is unlikely; slightly less than 1 percent (about 2,000 acres) of TVA ROW is known to contain rare plant habitats currently. If rare plant communities are identified along the transmission corridor, these areas would be documented in the O-SAR database and TVA biologists and operations staff would work together to ensure the habitats are protected during vegetation maintenance activities. This would ensure that the most potentially damaging tools, like broadcast herbicide, would not be used in ROW supporting important grassland habitats and that the proposed vegetation management activities would not have significant effects on terrestrial plant ecology of the region.

3.8.1.2.5. Alternative C

3.8.1.2.5.1. Construction and Operation of Solar and Storage Facilities

Alternative C would result in construction of solar and storage facilities that have the potential to affect vegetation communities. As noted in Table 3.2-1, TVA has evaluated typical effects associated with the development of solar facilities. Solar facilities average approximately 1.2 acres of forest clearing per MW, with a range of 0 to 15 acres per MW. Based on the need for approximately 3,000 MW of solar facilities, approximately 3,600 acres of forest would be cleared with a maximum of 45,000 acres cleared. While the number of sites is dependent upon the generating capacity, TVA assumes that these impacts would be spread over approximately thirty 100 MW sites. In addition, TVA is proposing to expand future solar facilities by 10,000 MW by 2035 in order to meet customer and system demand, which would result in an average of 12,000 acres cleared (maximum 150,000 acres). TVA and solar developers would minimize effects to vegetation by siting facilities on previously cleared land and configuring the solar arrays, access roads, and other infrastructure to avoid sensitive vegetation communities. BESS sites are typically small enough to be sited to avoid adverse vegetation effects. Appropriate field investigations for rare plant communities would be completed prior to land disturbing activities.

Vegetation would be maintained in the long-term by traditional mowing and trimming around structures on a regular basis, depending on growth rate. Sheep grazing may also be employed to control invasive weed outbreak.

Cumulative effects to vegetation may occur under Alternative C with the addition of 10,000 MW of solar identified in the 2019 IRP throughout the TVA PSA. Based on the average of 1.2 acres of forest clearing per MW, this would result in potential vegetation effects to approximately 12,000 acres within the TVA PSA. Cumulative effects to vegetation would be minimized through proper siting of solar facilities and the use of BMPs.

3.8.1.2.5.2. Transmission and Other Components

As noted in Table 3.3-1, transmission lines typically result in an average of 5.5 acres of forest clearing per mile of new line. Based on TVA's evaluation, an average of 1.7 miles of new transmission line are needed for solar facilities, which indicates that approximately 9.35 acres of forest may be impacted for each solar facility. Based on the assumption of thirty 100 MW solar sites to generate 3,000 MW, Alternative C would result in approximately 280.5 acres of impacts to forest during transmission line construction. Transmission lines would be maintained as described in Section 3.8.1.2.4.3.

Cumulative effects to vegetation may occur under Alternative C with the addition of 10,000 MW of solar identified in the 2019 IRP throughout the TVA PSA. Transmission lines would be required to support the new solar facilities. Cumulative effects to vegetation would be minimized through proper siting of solar facilities and the use of BMPs.

3.8.2. Wildlife

Although limited information exists for direct wildlife observations for the action alternatives, inferences can be made depending on the potential habitats present based on field surveys (if wildlife is not directly observed) or desktop analyses. For the purposes of the wildlife evaluation, threatened and endangered species and migratory species are included in Section 3.8.4 and therefore this section considers only those not listed with state or federal protections.

3.8.2.1. Affected Environment

3.8.2.1.1. CUF Reservation

As described in Section 3.8.1.1.1, most of the CUF site is forested with deciduous plant communities (58.9 percent) or disturbed fields (32.4 percent). The majority of these forests have experienced extensive previous disturbance and are degraded by non-native species infestations. The plant site is predominantly a disturbed area that contains an active coal-fired fossil plant and associated infrastructure. The site is developed for industrial power generation and remains in continuous operation and maintenance, including active ash pond closures. The area outside the CUF plant site to the south and west consists of rolling to steeper grade terrain dissected by tributaries to the floodplain complex associated with the embayment of Wells Creek. Rolling terrain has been converted from cattle pasture to naturalized habitat, where successional communities are evident. Steeper grade slopes were found to be comprised of mature upland forest. Old Scott Road is a gravel road passing east-west through the CUF Reservation. Numerous streams and wetlands are present as described in Section 3.6. The study area also contains electrical distribution and transmission line rights-of-way, where vegetation is maintained at low stature compatible with conductor clearance. Surface waters and wetlands on site are shown on Figure 3.6-1, and vegetation communities shown on Figure 3.8-1.

Field surveys were performed by TVA in July 2021 with a focus on identifying general wildlife and habitats on the CUF Reservation. Field review determined that the majority of the plant site near buildings and settling ponds holds little value for wildlife (TVA 2021h). Filled and capped ponds also hold little wildlife value; however, surface waters (i.e., the Cumberland River and associated tributaries) and wetlands immediately surrounding the plant offer habitat for shorebirds, wading bird, waterfowl, reptiles (including turtles and snakes), and amphibians. The large swaths of forest that surround the plant site hold value for a wider variety of wildlife species and are where the majority of the species were observed during the survey (Table 3.8-4). The least disturbed forest was found in the large fragments immediately adjacent to the landfill and along the northwestern edge of Wells Creek. Wildlife observed during the

2021 field surveys via visual observations, sign (e.g., scat), or call, and species identified from bat mist net surveys in 2011 are listed in Table 3.8-4.

Table 3.8-4. Wildlife Observed in or near the Project Area, Stewart County, Tennessee, July 2021 (TVA 2021h).

Common Name	Scientific Name	Habitat in Which Observation Occurred				
		Forest	Field	Stream/Wetland	Road	Industrial
Insects						
American dagger moth caterpillar	*Acronicta americana*	X				
Painted lady butterfly	*Vanessa cardui*		X			
Spicebush swallowtail butterfly	*Papilio troilus linnaeus*		X			
tiger swallowtail butterfly	*Palilio glaucus*	X				
Birds						
Acadian flycatcher	*Empidonax virescens*	X				
American crow	*Corvus brachyrhynchos*	X				
Barred owl	*Strix varia*	X				
Black vulture	*Coragyps atratus*					X
Bobwhite	*Colinus virginianus*		X			
Broad-winged hawk	*Buteo platypterus*		X			
Carolina chickadee	*Poecile carolinensis*	X				
Carolina wren	*Thryothorus ludovicianus*	X				
Cliff swallow	*Petrochelidon fulva*				X	
Common yellowthroat	*Geothlypis trichas*	X				
Double crested cormorant	*Nannopterum auritum*			X		
Downy woodpecker	*Dryobates pubsescens*	X				
Eastern wood pewee	*Contopus virens*	X				
Field sparrow	*Spizella pusilla*		X			
Great blue heron	*Ardea herodias*			X		
Great egret	*Ardea alba*			X		
Indigo bunting	*Passerina cyanea*	X				
Mourning dove	*Zenaida macroura*	X				
Northern cardinal	*Cardinalis*	X				
Northern mockingbird	*Mimus polyglottos*	X				
Pied-billed grebe	*Podilymbus podiceps*			X		

Common Name	Scientific Name	Habitat in Which Observation Occurred				
		Forest	Field	Stream/Wetland	Road	Industrial
Piliated woodpecker	*Dryocopus pileatus*	X				
Red-bellied woodpecker	*Melanerpes carolinus*	X				
Ruby throated hummingbird	*Archilochus colubris*	X				
Scarlet tanager	*Piranga olivacea*	X				
Summer tanager	*Piranga rubra*	X				
Tufted titmouse	*Baeolophus bicolor*	X				
White-breasted nuthatch	*Sitta carolinensis*	X				
Wild turkey	*Meleagris gallopavo*		X			
Wood thrush	*Hylocichla mustelina*	X				
Yellow-bellied cuckoo	*Coccyzus americanus*		X			
Mammals						
Armadillo	*Dasypus novemcinctus*	X				
Common Raccoon	*Procyon lotor*	X				
Coyote	*Canis latrans*				X	
Big brown bat	*Eptescius fuscus*	X				
Eastern red bat	*Lasiurus borealis*	X				
Evening bat	*Nycticeius humeralis*	X				
Southeastern bat	*Corynorhinus refinesquii*	X				
Tricolored bat	*Perimyotis subflavus*	X				
Eastern fox squirrel	*Sciurus niger*	X				
Eastern gray squirrel	*Sciurus carolinensis*	X				
White-Tailed Deer	*Odocoileus virginianus*	X				
Reptiles						
Black rat snake	*Pantherophos obsoletus*	X				
Eastern box turtle	*Terrapene Carolina carolina*	X				
Eastern garter snake	*Thamnophis sirtalis sirtalis*	X				
Red-eared slider	*Trachemys scripta elegans*			X		
Amphibian						
Fowlers toad	*Anazyrus fowleri*	X				
Green frog	*Rana clamitans*			X		
Hyla spp.	*Hyla* spp.				X	

Common Name	Scientific Name	Habitat in Which Observation Occurred				
		Forest	Field	Stream/Wetland	Road	Industrial
Salamander (unknown spp.)	--	X				
American toad	*Bufo americanus*	X				

Developed and disturbed areas, such as the CUF Reservation, are home to a large number of common species, including American robin, American crow, Carolina chickadee, European starling, house finch, house sparrow, mourning dove, Carolina wren, northern cardinal, northern mockingbird, black vulture, and turkey vulture (National Geographic 2002). Mammals found in this community type include eastern gray squirrel, striped skunk, and raccoon. Road-side ditches provide potential habitat for amphibians, including American toad (toad tadpoles were observed in a ditch on the project site) and upland chorus frog. Reptiles potentially present include red-bellied snake, gray rat snake, and smooth earth snake (Powell et al. 2016; Gibbons and Dorcas 2005).

Deciduous forests located on the CUF Reservation provide habitat for an array of terrestrial animal species (National Geographic 2002) including birds (e.g., pileated woodpecker, red-tailed hawk, blue jay, cardinal, and American robin, all of which were observed during field investigations), mammals (coyote, eastern chipmunk, eastern woodrat, North American deermouse, and woodland vole [Kays and Wilson 2002]), and reptiles and amphibians (gray ratsnake, midland brownsnake, and scarlet kingsnake [Powell et. al 2016]; dusky salamander, marbled salamander, spotted salamander, and Cope's gray tree frog [Powell et. al 2016; Niemiller and Reynolds 2011]).

Forested areas also provide roosting habitat for several species of bats, particularly in areas where live trees exhibit exfoliating bark and/or dead-tree snags with crevices are present. Open areas, such as over open water or fields, also provides foraging habitat for bats. Some examples of common bat species potentially found in this habitat are the big brown, eastern red, evening, hoary, and silver-haired bats. Mist net surveys completed by Environmental Solutions and Innovations, Inc. in 2011 captured big brown bat, eastern red bat, evening bat, southeastern bat, and tricolored bat on the CUF Reservation near Old Scott Road.

Wetlands and associated vegetation areas provide habitat for such birds as the prothonotary warbler, northern harrier, red-winged blackbird, song sparrow, swamp sparrow, and white-throated sparrow (National Geographic 2002). Mammals that may use this habitat include the American beaver, eastern harvest mouse, marsh rice rat, muskrat, and swamp rabbit (Kays and Wilson 2002). The eastern black kingsnake, eastern ribbonsnake, common gartersnake, midland watersnake, and gray ratsnake are all potential wetland reptiles (Powell et. al 2016). In addition to the amphibians listed above, the red-spotted newt, as well as the American bullfrog, bird-voiced tree frog, green frog, northern cricket frog, and pickerel frog, are examples of some amphibians that may be present in wetlands on the CUF Reservation (Niemiller and Reynolds 2011).

Agricultural fields, hayfields/pastureland, and other herbaceous areas, such as lawns, offer habitat to such bird species as the blue grosbeak, brown-headed cowbird, brown thrasher, common grackle, common yellowthroat, eastern bluebird, eastern kingbird, eastern meadowlark, eastern towhee, field sparrow, grasshopper sparrow, house finch, and northern mockingbird among others (National Geographic 2002). Mammals potentially present in fields or pasture include the eastern cottontail, eastern harvest mouse, eastern woodrat, hispid cotton

rat, red fox, and striped skunk (Kays and Wilson 2002). Reptiles with the potential to occur in agricultural portions of the Project Site include the eastern milk snake, gray ratsnake, smooth earth snake, southern black racer, and eastern slender glass lizard (Powell et. al 2016).

3.8.2.1.2. Alternative A

3.8.2.1.2.1. Proposed CC Plant

Alternative A includes the construction of a new CC plant of approximately 1,450 MW and short transmission lines on the existing Cumberland Reservation; therefore, the habitats and species that may be present at the site of the proposed CC plant comprise a subset of those discussed in Section 3.8.2.1.1. A review of the field studies (stream and wetland delineations) and other supporting information (such as NLCD and aerial imagery) showed the majority of the CC plant site consists of former agricultural fields, small groupings of trees and tree-lined fence rows, wetlands (29.4 acres), and streams (922 lf of perennial stream). The disturbed field comprises the same type of vegetation as the primary CC plant site and consists of former agricultural fields. The wildlife listed under “field,” “stream/wetland,” and possibly “forest” on Table 3.8-3 may be found on the CC plant site.

3.8.2.1.2.2. Natural Gas Pipeline Corridor

TGP conducted wildlife surveys from June 2021 through April 2022 in the corridor as part of the Environmental Report (TGP 2022c), which TVA draws upon for this analysis. Habitat surveys resulted in the identification of four general habitat types in the natural gas pipeline corridor: mixed hardwoods, wetland systems (PEM and PFO types), streams and riparian areas, and open agricultural/pastureland (including the adjacent transmission line ROW). These habitats are summarized as follows:

Upland Forest

Upland forests consisting of mixed hardwood canopy. Common species observed include green ash, American sycamore, box elder, sweetgum, tulip poplar, southern red oak, white oak, American beech, pignut hickory, hornbeam/ironwood, and loblolly pine. Various shrubs, vines, and herbaceous plants make up the understory in these forested areas (TGP 2022c).

The upland forest habitats that occur within the natural gas pipeline corridor provide necessary food, cover, and young-rearing habitat for a wide variety of wildlife species. The wildlife communities within forested habitats depend largely on tree species composition and successional stage. Nuts from trees such as oaks and hickories provide food for deer, turkey, mice, and squirrels. Berries from understory shrubs and woody vines also may provide important wildlife foods. Secondary canopy shrubs and saplings, brush piles, and fallen logs provide cover for various small- to medium-sized mammals. Large standing dead trees (particularly with cavities and/or exfoliating bark) provide nesting or roosting sites for a variety of birds and mammals including bats, as well as foraging opportunities for birds. Forested areas, particularly large unfragmented tracts, provide important habitat for warblers and other migrating and nesting songbirds. Game species may spend all or most of their time in these forested habitats. Species observed during field efforts include white-tailed deer, raccoons, eastern cottontail rabbits, gray squirrels, cotton mice, northern cardinals, northern mockingbirds, American crows, blue jays, pileated woodpeckers, wild turkeys, and green anoles. Additionally, TGP performed bat surveys within the pipeline lateral that identified the big brown bat, evening bat, eastern red bat, the federally proposed endangered tricolored bat, and the federally endangered gray bat (TGP 2022c).

Upland Scrub/Upland Herbaceous
These areas include open pasture/agricultural land and ROW. Common species observed include high bush blackberry, flat-top goldenrod, broom sedge, tickseed, bermudagrass, dog fennel, bluestem, ragweed, and goldenrod. Early successional shrubs also were present, such as thickets of blackberry and Japanese honeysuckle, as well as scattered pine and hardwood seedlings and saplings (TGP 2022c).

Open/agricultural lands generally provide poor to moderate quality wildlife habitat in the proposed natural gas pipeline corridor. This habitat is important to many of the same species found in the forested habitats, because it provides "edge" habitat that is important for feeding and raising young. Edge habitats are transition zone areas where two different habitat types meet, such as forested and open land or agriculture fields. These transition zones provide distinct changes in food types available, unique nesting or breeding habitats, and travel lanes. In addition to the increased diversity of wildlife and plant communities, these areas also are used for foraging and predation. Species observed during field efforts include white-tailed deer, eastern cottontail rabbits, cotton mice, mourning doves, common grackles, red-winged blackbirds, eastern bluebirds, red-tailed hawks, green anoles, green tree frogs, and clouded sulphur butterflies (TGP 2022c).

Surface Waters and Wetlands
Wetlands, lakes, small ponds, and streams within or crossing the pipeline corridor may support similar wildlife species to those support by upland habitats, but they also provide habitat for species that are dependent on abundant sources of water. Species observed during field efforts include white-tailed deer, raccoons, egrets, great blue herons, wood ducks, mallards, Canada geese, green tree frogs, American bullfrogs, various crayfish burrows, and a single painted creekshell relic that was identified during mussel surveys. Aquatic life associated with supportive waterbodies is further discussed in Section 3.8.3.1.2.2.

Common wildlife species found in Tennessee that could occur within the pipeline corridor are listed in Table 3.8-5 (TGP 2022c). No critical habitat was identified within or immediately adjacent to the corridor and the corridor does not cross and federal or state-managed lands.

Table 3.8-5. Common Wildlife Species Potentially Occurring in the Pipeline Corridor

Common Name	Scientific Name
Mammals	
Gray fox	*Vulpes vulpes*
Bobcat	*Lynx rufus*
Common raccoon	*Procyon lotor*
White-tailed deer	*Odocoileus virginianus*
River otter	*Lutra canadensis*
Eastern striped skunk	*Mephitis mephitis*
Birds	
Cedar waxwing	*Bombycilla cedrorum*
Red-winged blackbird	*Agelaius phoeniceus*
Solitary sandpiper	*Tringa solitaria*
Greater yellowlegs	*Tringa melanoleuca*
American black duck	*Anas rubripes*
Wood duck	*Aix sponsa*

Common Name	Scientific Name
Mallard	*Anas platyrhynchos*
Reptiles	
Eastern box turtle	*Terrapene carolina carolina*
Red milk snake	*Lampropeltis triangulus syspila*
Rough green snake	*Opheodrys aestivus*
Amphibians	
Slimy salamander	*Plethodon glutinosus*
Spring peeper	*Pseudacris crucifer*
Gray treefrog	*Hyla versicolor*

Source: TGP 2022c

3.8.2.1.3. Alternative B

3.8.2.1.3.1. Johnsonville Reservation

The location of the proposed CT plant on the Johnsonville Reservation is adjacent to the Tennessee River and consists of disturbed and developed land with small areas of manicured lawn. The JCT Reservation holds little wildlife value and only common bird and mammal species accustomed to developed or urban areas are likely to be present, such as American robin, various sparrows, blue jays, northern cardinals, juncos, chickadees, starlings, crows, mockingbirds, squirrels, chipmunks, rabbits, raccoons, opossums, skunks, woodchucks, mice and deer (USDA, undated).

3.8.2.1.3.2. Gleason Reservation

Wildlife habitat on the proposed Gleason CT plant site consists of two primary types: early successional habitat and deciduous forest. Early successional habitat makes up approximately 51 percent of the proposed CT plant site, consisting primarily of agricultural hay fields and fields of grasses and forbs. Small stands of woody shrubs and tree saplings occur along drainage areas. Depending on the quality of the agricultural land, species found there may include quail, mourning doves, songbirds, leopard frogs, bats, deer, and coyotes (USDA, undated).

Given the vegetation community typically found in oak-hickory forests of the southeastern plains and hills ecoregion, birds found in the forested area of the southern portion of Gleason Reservation may include blue jays, red-bellied woodpecker, red-eye vireo, Carolina wren, wood thrush, great crested flycatcher, tufted titmouse, and yellow-bellied cuckoo. Mammals in this tract may include fox squirrel, gray squirrel, and flying squirrel. Herpetofauna in this area could consist of Eastern box turtle, hognose snake, garter snake, five-line sink, and rough green snake (Bryant et al. 1993).

3.8.2.1.3.3. Transmission Corridors

A desktop review of the proposed 40-mile TL corridor identified land use along the TL as primarily agricultural, with smaller portions of forested area. Bodies of water, such as wetlands, streams, and ponds, are also present based on NHD and NWI databases. Overall, wildlife habitats present on the transmission corridor are likely common to the region and, as habitats, are not unique or uncommon.

Deciduous forests provide habitat for an array of terrestrial animal species. Avian species found in this habitat are downy woodpecker, eastern screech-owl, red-tailed hawk, white-breasted nuthatch, and yellow-billed cuckoo (National Geographic 2002). This area also provides foraging and roosting habitat for several species of bat, particularly in areas where the forest

understory is more open. Some examples of bat species likely found within this habitat are big and little brown, eastern red, evening, hoary, Rafinesque's big-eared, and silver-haired. Coyote, eastern chipmunk, eastern woodrat, North American deermouse, and woodland vole are also likely mammalian species present within this habitat (Kays and Wilson 2002). Gray ratsnake and DeKay's brown snake are common reptilian residents of this habitat (Powell et al. 2016). In forest sections with aquatic features, amphibians likely found in the area include dusky, marbled, and spotted salamanders, as well as barking and Cope's gray treefrogs (Powell et al. 2016; Niemiller et al. 2011).

Wetland habitat provides resources for such avian species as northern harrier, red-winged blackbird, song sparrow, swamp sparrow, and white-throated sparrow (National Geographic 2002). Mammalian species that may utilize this habitat are American beaver, eastern harvest mouse, marsh rice rat, muskrat, and swamp rabbit (Kays and Wilson 2002). Eastern black kingsnake, eastern ribbonsnake, common gartersnake, midland watersnake, and gray ratsnake are all wetland reptilian species potentially present (Powell et al. 2016). Eastern red-spotted newt and three-lined salamanders, as well as American bullfrog, green frog, northern cricket frog, pickerel frog, and southern cricket frog, are examples of some amphibian species that are likely present (Niemiller and Reynolds 2011).

Pasture and agricultural fields offer habitat to a multitude of species such as blue grosbeak, brown-headed cowbird, brown thrasher, common grackle, common yellowthroat, Bewick's wren, dickcissel, eastern bluebird, eastern kingbird, eastern meadowlark, eastern towhee, field sparrow, grasshopper sparrow, house finch, northern mockingbird, and prairie warbler among others (National Geographic 2002). Mammalian species likely present in this habitat include eastern cottontail, eastern harvest mouse, eastern woodrat, hispid cotton rat, red fox and striped skunk (Kays and Wilson 2002). Reptilian species with the potential to occur in the project area are eastern milk, gray ratsnake, smooth earthsnake, and southern black racer snakes, as well as eastern slender glass lizard (Powell et al. 2016).

3.8.2.1.4. Alternative C

3.8.2.1.4.1. Middle Tennessee TVA Power Service Area

Much of the wildlife described in prior sections would also be found in the general Middle Tennessee TVA PSA for this Action Alternative, particularly those found in forested or agricultural areas of the Western Highland Rim and Nashville Basin. Wildlife found in the forested areas such as those described for the Eastern and Western Highland Rim regions include ovenbirds (eastern), black-throated green warblers (eastern), black-and-white warbler (eastern), blue jay, red-eyed vireo, wood thrush, Carolina chickadee, hairy woodpecker, and wood peewee. Mammals in these regions include the smoky and pygmy shrews (eastern), short-tailed shrews, white-footed mouse, eastern chipmunk, golden mouse, red bat, brown bat, gray squirrel, flying squirrel, fox squirrels, gray fox, raccoons, opossums, striped skunks, and white-tailed deer (Bryant et al. 1993). Herpetofauna in this region include Eastern box turtle, garter snake, ground skink, black rat snake, hognose snake, five-lined skink, and rough green snake; and in areas near water, also slimy salamander, dusky salamander, American toad, and spring peeper (Bryant et al. 1993).

The Nashville Basin also includes a variety of birds such as blue jay, red-bellied woodpecker, red-eyed vireo, great crested flycatcher, tufted titmouse, Carolina wren, wood thrush, yellow-billed cuckoo, mockingbirds, mourning dove, and American robin (Bryant et al. 1993). Mammals in the Nashville Basin include short-tailed shrews, white-footed mouse, eastern chipmunk, red bat, little brown bat, eastern pipistrelle, fox squirrel, gray squirrel, and flying squirrel. Herpetofauna of this region includes eastern box turtle, hognose snake, garter snake, five-lined

skink, and rough green snake; and in areas near water, other species such as the slimy salamander, American toad, spring peeper, and spotted salamander may also be present.

3.8.2.2. Environmental Consequences

3.8.2.2.1. The No Action Alternative

Under the No Action Alternative, TVA would continue current plant operations until the scheduled retirement. TVA would implement all of the planned actions related to the current and future management and storage of CCRs. As a result, no new work would be conducted that could potentially alter project-related environmental conditions within each plant. Therefore, there would be no direct or indirect effects to wildlife because there would be no physical changes to the current conditions.

3.8.2.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Direct effects to common wildlife include temporary displacement and permanent displacement when vegetation and/or utilized habitat and utilized buildings and structures are removed. Little habitat exists within the CUF Plant demolition boundary, consisting only of ruderal open areas and a few areas of deciduous trees (Figure 3.8-1).While bat roosting habitat is not found within the demolition boundary, up to 46 acres of bat foraging habitat would be disturbed during demolition activities. However, bats would be foraging during night periods when demolition work is not occurring; therefore, effects to bats in this area would be negligible. Internal surveys of buildings proposed for demolition would occur prior to demolition to ensure colonies of bats or aggregations of other wildlife would not be impacted. See Section 3.8.4 for discussion of potential effects to osprey and other aggregations of protected migratory birds. Wildlife such as birds, reptiles, or amphibians on the shore of the Cumberland River could also be disturbed during demolition activities. Wildlife habituated to the area are likely to move to other suitable environments offsite or outside of the demolition boundary, which are plentiful, and it is expected that they would return to the project area upon project completion. Cumulative effects to wildlife may occur as a result of the RFFAs of CCR management activities occurring in proximity to the proposed D4 activities but are anticipated to be minor.

3.8.2.2.2.1. Environmental Justice Considerations

Negative effects to wildlife resulting from CUF coal facility retirement and D4 activities would be limited to the demolition boundary and would have no effect on EJ populations. While minor displacement of wildlife could result in more wildlife in nearby recreation areas and wildlife refuges, the benefits to human populations would be negligible.

3.8.2.2.3. Alternative A

3.8.2.2.3.1. Construction and Operation of CC Plant at CUF

The entire impact footprint for the proposed CC plant, construction laydown area, construction support area, and switchyard was classified as disturbed field during the 2021 field survey. The transmission line corridor consists mainly (99.9 percent) of disturbed field and a small portion (0.01 percent) of deciduous forest.

Vegetation removal and construction in the CC plant area and transmission corridors may result in direct effects to some common wildlife that may be immobile during the time of project activities (i.e., eggs, juveniles, hibernating individuals), particularly during breeding/nesting or winter seasons. While tree removal at this site between November 15 and March 31 would avoid direct effects to many species of wildlife that may breed/nest in this area, there would be a loss of habitat for these species. Habitat removal likely would disperse some mobile wildlife into

surrounding areas in an attempt to find new food sources, shelter sources, and to reestablish territories. Over time, species utilizing early successional habitat are likely to return to vegetated parts of the disturbed area following completion of construction activities.

Routine vegetation management of transmission line ROWs would have periodic effects on habitats within the ROW over the long-term. Methods may vary but are likely to include use of herbicides and various mechanical measures to control vegetation. Wildlife is expected to be displaced intermittently in conjunction with the presence of maintenance crews and the alteration of habitats. Maintenance of these ROWs as early successional habitats ensures habitat availability for species needing this type of habitat that may otherwise revert back to forest.

Cumulative effects of the project on common wildlife species are expected to be negligible. Proposed actions across the transmission line would permanently remove existing forested habitat for common wildlife. Following completion of the project, the ROW would be maintained as early successional habitat, scrub-shrub habitat, or herbaceous fields with wetland areas, which would provide habitat for numerous common wildlife species. While the proposed actions would result in alteration of habitats and displacement of resident wildlife species, effects to wildlife are not expected to result in notable large-scale habitat alteration or destabilization of any wildlife species. Therefore, effects to wildlife resulting from the construction and operation of the proposed CC plant would be minor.

3.8.2.2.3.2. Construction and Operation of Natural Gas Pipeline

Vegetation clearing will cause temporary impacts due to general disturbance from construction activities and temporary and long-term impacts due to habitat loss. Wildlife will avoid using areas during active construction. In areas that were not previously forested, disruption of habitat use will be temporary in nature, and the species would be able to utilize the area in subsequent seasons, post-construction (TGP 2022c).

Long-term impacts on wildlife habitat due to construction and operation of the pipeline would be limited to the clearing of upland and wetland trees required for temporary workspace and the permanent maintained ROW. To the extent practicable, feasible, and legally permissible, TGP has routed the pipeline to follow the existing TVA transmission line and following existing forest edges, “thereby minimizing the acreage of forested land crossed and the relatively greater impacts that could be associated with clearing an entirely new ROW through a contiguously forested area” (TGP 2022c). The use of HDD for crossing three streams would reduce forest clearing adjacent to the streams. For portions of the pipeline installed by open trenching, areas cleared for temporary workspace and for pipeline construction would quickly regenerate and provide additional open land habitat (i.e., scrub/shrub and old-field). The temporary workspace areas would not be maintained post-construction and would revert to forested habitat over time. Areas of early successional habitat that are impacted by construction would naturally revegetate within one to two growing seasons to their pre-construction condition and cover type (TGP 2022c).

Few wildlife populations that use the pipeline corridor would be permanently, adversely affected by the proposed pipeline. “Although temporary impacts on food, cover, and water sources may occur, many of the species located within the [pipeline corridor] are specialized in such a way that construction of the pipeline and its long-term maintenance would not inhibit the overall fitness or reproductive output of the populations as a whole. [Many] species are not dependent on the ROW or transitional areas to provide all their habitat requirements. Some of the mammal, bird, reptile, and amphibian species are adaptive to changing habitat conditions and possess

the ability to expand or shift their home ranges temporarily to find alternative sources of food, water, and shelter until construction is completed and the ROW habitats become re-established" (TGP 2022c). The wildlife species most affected would be those, among them several bird species, that require large, unfragmented tracts of forest. About 125 acres of forest would be cleared, primarily edge habitat along the existing ROW. Although an analysis of the resulting forest fragmentation has not been conducted, the adverse impacts would be localized and adversely affect a relatively small number of individuals of several species in the corridor area (TGP 2022c).

According to TGP's Resource Report 3 (TGP 2022c):

> Potential impacts on small terrestrial wildlife species that may be present during construction include injury or death for less-mobile species (e.g., reptiles and invertebrates) due to crushing from vehicles and equipment. During construction activities, most mobile wildlife species (e.g., birds, many mammals) would be able to avoid the active work area. Following construction, most of the areas cleared for temporary workspace and for pipeline construction would naturally re-vegetate to pre-construction conditions, and resident wildlife species utilizing early successional habitats will not be subject to long-term impacts.
>
> Noise, dust, and human activity at the [pipeline] worksites could disturb wildlife species, causing them to leave or avoid the area. Human activity near nests could also lead to nest failure or abandonment, depending on the species' sensitivity to disturbance [and the timing of the proposed activities]. Impacts during construction may include individual disruption, habitat avoidance, social disruption, habitat disruption, and localized population effects. Following construction, wildlife and bird species would return to the re-vegetated areas.
>
> Clearing and grading of the construction ROW could serve as a barrier to wildlife movement. Without vegetative cover, some species may be less likely to cross the cleared ROW. Unprotected exposure could make wildlife more vulnerable to predation. The level of impact would be determined by factors such as ROW corridor width, the behaviors of individual species, and the density of surrounding vegetative cover. The cleared ROW could also facilitate movement for other species by serving as a corridor for travel. Stockpiling of cleared vegetation, topsoil, and trench spoil during construction could temporarily inhibit wildlife movement by creating physical barriers for smaller species. Given the location of the proposed pipeline in the vicinity of roadways and developed areas, including other utility corridors, which result in existing barriers and disturbed habitats, it is anticipated that the [pipeline] would not inhibit large movements of wildlife during construction or operation and maintenance activities.
>
> Temporary and permanent impacts on wildlife from construction and operation of the proposed aboveground facilities are expected to be negligible. The relatively small areas inside the fence lines of the aboveground facilities would be graveled and would not provide wildlife habitat value, but preclusion of these areas does not significantly reduce the amount of overall habitat available for wildlife in adjacent areas. Some wildlife may avoid the areas in close proximity to the facilities due to noise emissions during operation.

> TGP and its contractors would strive to minimize impacts on wildlife by adhering to the FERC Plan and FERC Procedures (with requested deviations), as adopted in the Project Environmental Construction Management Plan (ECMP) and constructing the facilities as quickly and efficiently as possible. Subject to receipt of all necessary regulatory approvals, TGP proposes to fell trees and clear the ROW beginning in mid-October 2024 to minimize impacts on breeding birds. The USFWS has provided concurrence with TGP's plans to minimize effects on nesting birds by clearing trees outside of the period between April 1 and October 15 and to conduct maintenance mowing outside of the period between April 1 and October 14. […] Additional timing restrictions on vegetation clearing may be implemented by other federal and state agencies based upon the final results and impact assessments for rare, threatened, and endangered species; […] these timing restrictions would likely be limited to specific areas identified as suitable habitat for rare species within the [pipeline] workspaces.
>
> BMPs that would be implemented to minimize impacts to wildlife during construction include the following:
>
> - properly disposing of trash and food debris in secured containers;
> - allowing wildlife that has entered the natural gas pipeline corridor work area to leave the area on their own;
> - providing environmental awareness training to all construction personnel working on the natural gas pipeline corridor;
> - checking for wildlife under vehicles and equipment that have been stationary for more than 1 hour and each morning prior to moving or operation;
> - complying with posted speed limits;
> - prohibiting firearms or pets at the work sites;
> - checking trenches, excavations, and uncapped pipe segments for wildlife;
> - limiting the amount of time trenches remain open, to the extent practicable;
> - reseeding of areas when construction activities have ceased;
> - maintaining side slopes with hard plugs (unexcavated portions of trench); and
> - installing escape ramps and breaks in the spoil every 0.5 mile.

Cumulative effects to wildlife may occur as a result of the past/present and RFFAs in proximity to the proposed pipeline but are anticipated to be minor. The cumulative impacts analysis for wildlife includes lands within one mile of the natural gas pipeline corridor workspaces. "By mostly siting the pipeline within or adjacent to existing pipeline, utility, and transportation corridors and revegetating temporary construction workspaces following construction, the [pipeline] is expected to have negligible permanent impacts on wildlife. Temporary direct or indirect impacts on resident wildlife may result from construction activities associated with the [pipeline] facilities. Direct impacts may include habitat loss and injury/mortality from active

construction, while indirect impacts can result from temporary displacement or behavioral changes due to construction noise and activity" (TGP 2022c).

Because most impacts on wildlife resulting from the natural gas pipeline corridor are expected to be "temporary and generally limited to the construction phase, only those [RFFAs] with construction that overlaps the timeframe of [pipeline] construction would result in a cumulative impact on wildlife. […]. No actions were identified that might impact wildlife during the same timeframe and in the same [cumulative impact assessment area] as the [corridor]. Therefore, cumulative impacts on wildlife resulting from the [pipeline] are not anticipated" (TGP 2022c). TVA has reviewed the results of these analyses and concurs with TGP's conclusions, as presented in Resource Report 3 (TGP 2022c).

3.8.2.2.3.3. Summary of Alternative A

Generally, impacts to wildlife from the construction and operation of the proposed CC plant would be minor due to the removal of low-quality habitat and temporary period of construction activities. Almost the entire impact footprint for the CC plant, construction laydown and support areas, switchyard, and transmission line corridors are classified as disturbed field which hold little wildlife value. However, a small portion of deciduous forest that falls within the transmission line corridor and strips of trees within or on the edges of the disturbed fields currently provide moderate quality habitat for common species of bats and birds would be lost. Temporary impacts to forested areas would be a long-term impact due to the slow regeneration of forested areas following construction. However, tree removal would occur in winter when most wildlife is not nesting and many species of birds have migrated away from the region, thereby avoiding or minimizing the potential for direct effects.

Vegetation clearing of the pipeline corridor will cause temporary impacts due to general disturbance from construction activities and temporary and long-term impacts due to habitat loss. Long-term impacts on wildlife would be limited to the clearing of upland and wetland trees (habitat) required for temporary workspace and the permanent maintained ROW. Impacts to migratory birds and bat species would be minimized to the extent practicable by adhering to time of year restrictions on tree clearing.

Few wildlife populations that use the pipeline corridor would be permanently, adversely affected by the proposed pipeline. The wildlife species most affected would be those that require large, unfragmented tracts of forest. To the extent practicable, the pipeline was routed to follow the existing TVA transmission line and following existing forest edges, thereby minimizing the acreage of forested land crossed and the relatively greater impacts that could be associated with clearing an entirely new ROW through a contiguously forested area. Clearing for temporary workspaces would regenerate following disturbance and provide first herbaceous habitat followed by shrub-scrub habitat, and finally forested habitat over time.

Operations of the CC plant and pipeline, including regular vegetation maintenance along transmission lines and the natural gas pipeline, would have a long-term though periodic impact on wildlife using these environments for habitat. Wildlife is expected to be displaced intermittently in conjunction with the presence of maintenance crews and the alteration of habitats.

Overall, impacts to wildlife would primarily occur in the form of habitat loss associated with tree clearing for the permanent natural gas corridor. As stated previously, the proposed alignment of the corridor was routed as to minimize forest clearing and fragmentation to the extent possible.

However, total impacts from clearing would still result in permanent, long-term impacts to wildlife species using that habitat.

3.8.2.2.3.4. Environmental Justice Considerations

Effects to wildlife that would result from the proposed natural gas pipeline lateral would be minor, while outside of TVA-owned reservations. As much as feasible, TGP would locate the natural gas pipeline generally parallel and adjacent to existing electric transmission lines owned and operated by TVA, which would reduce effects to wildlife. However, habitats would be altered and wildlife displaced temporarily and permanently from portions of the corridor. These effects would occur in areas where EJ populations are prominent, as seven of the 10 census block groups are EJ populations, and could result in amplified effects for EJ populations that currently utilize wildlife from these areas. While displacement could result in more wildlife in nearby areas, the benefits to human populations are anticipated to be negligible.

3.8.2.2.4. Alternative B

3.8.2.2.4.1. Construction and Operation of JCT Plant on Johnsonville Reservation

The proposed JCT plant would be located on previously disturbed, developed portions of the reservation. Effects to the common wildlife in the vicinity would be negligible. Wildlife in the area would likely move away from the area during construction activities and no direct harm would occur. See the T&E section for discussion of potential effects to osprey. Cumulative impacts to wildlife would not occur, as the RFFA is located on a developed portion of the JCT Reservation.

3.8.2.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

Approximately 39 acres of agricultural land and 34 acres of forested land would be impacted by the construction of the Gleason CT plant. Direct effects could occur to some common wildlife that may be immobile during the time of project activities (i.e., eggs, juveniles, or hibernating individuals), particularly during breeding/nesting and winter seasons. Habitat removal likely would disperse mobile wildlife into surrounding areas in an attempt to find new food sources, shelter sources, and to reestablish territories. Over time, species utilizing early successional habitat are likely to return to the disturbed area following completion of construction activities. During siting of the plant, TVA would avoid and minimize effects to forested areas or other sensitive habitats. Suitable alternate habitat exists in areas immediately adjacent to the Gleason Reservation and are common to the area. Populations of common wildlife species likely would not be significantly impacted by the proposed CT plant. Cumulative effects to wildlife would not occur.

3.8.2.2.4.3. Transmission and Other Components

Land use along the 40-mile TL corridor route primarily consists of agricultural land with smaller portions of forested area (see Section 3.10.2.3.3). Forested areas would require clearing of forested habitats and conversion to herbaceous or scrub/shrub habitat (see Section 3.8.1.2.4.3). Effects to wildlife would resemble those that are described in Section 3.8.2.2.3.2 for the natural gas pipeline lateral. While wildlife habitats would be impacted, suitable alternate habitat likely exists in areas immediately adjacent to the proposed TL. Populations of common wildlife species likely would not be significantly impacted by the proposed TL. Field studies would be conducted to assess potential affects to wildlife and birds of conservation concern that may be using habitat along the TL corridor.

Species using herbaceous and/or scrub-shrub habitat types could use the transmission line corridor. Continued maintenance of the transmission line vegetation would result in periodic disturbance of wildlife in the area, but would likely return to the corridor following completion of the maintenance activities.

3.8.2.2.5. Alternative C

3.8.2.2.5.1. Construction and Operation of Solar and Storage Facilities

Alternative C would result in construction activities that have the potential to affect wildlife directly or indirectly. As noted in Table 3.2-1, TVA has evaluated typical effects associated with the development of solar facilities. Nine percent of solar projects studied resulted in effects to migratory birds of conservation concern. Based on the assumption of thirty 100 MW solar sites, approximately 3 sites would result in effects to migratory birds of conservation concern. None of the solar facilities impacted bald or golden eagles. TVA and solar developers typically minimize effects to wildlife by siting facilities on previously disturbed land, such as agricultural or silvicultural sites, or land with few sensitive wildlife habitats; however, forested areas may be affected by solar facility development. As noted in the IRP EIS (TVA 2019b), the maintenance of a permanent vegetative cover on a solar facility, particularly when composed of native plant species, can also increase local wildlife diversity (Beatty et al. 2017). Traditional mowing/trimming would be performed regularly for vegetation maintenance; sheep grazing may also be employed to control invasive weed outbreak. Depending on the size and habitat impacted at each solar site, habitat fragmentation could occur. Adverse effects of fragmentation on wildlife would be localized and would adversely affect small numbers of individuals or local populations of several species in the project area

Cumulative effects to wildlife may occur under Alternative C with the addition of 10,000 MW of solar identified in the 2019 IRP throughout the TVA PSA but would be minor through proper siting of solar facilities and the use of BMPs.

3.8.2.2.5.2. Transmission and Other Components

Based on studies performed on previous TVA solar facilities, an average of 1.7 miles of new transmission line are needed for each solar facility (approximately 51 miles assuming thirty 100 MW solar sites), which have the potential to affect common wildlife and their habitats. While wildlife habitats would be impacted, suitable alternate habitat likely exists in areas immediately adjacent to the proposed TLs. Populations of common wildlife species likely would not be significantly impacted by the proposed TLs. Cumulative effects to wildlife may occur under Alternative C with the addition of 10,000 MW of solar identified in the 2019 IRP throughout the TVA PSA but would be minor through proper siting of transmission lines and the use of BMPs.

3.8.3. Aquatic Life

Aside from the ESA and related state laws, as well as harvest regulations established by states, the CWA is the primary law protecting aquatic life. The CWA is the primary federal statute that governs the discharge of pollutants and fill materials into Waters of the U.S. under Sections 401, 402, and 404. Water quality standards and NPDES discharge limits are established, in part, to protect aquatic life. CWA Section 316 regulates (a) wastewater discharges in order to minimize adverse effects of heat on aquatic life, and (b) the design and operation of cooling water intake structures to minimize adverse effects to aquatic life from entrainment and impingement.

3.8.3.1. Affected Environment

3.8.3.1.1. CUF Reservation

The primary aquatic environments related to CUF include Barkley Reservoir (Cumberland River, a tributary to the Ohio River), Wells Creek, and Scott Branch (Figure 3.6-1). The Cumberland River is impounded prior to its confluence with the Ohio River to create Lake Barkley. Near CUF, approximately 72 miles upstream of Lake Barkley Dam, Lake Barkley-Cumberland River is more riverine. CUF is located along the left descending bank near RM 103. Lake Barkley-Cumberland River adjacent to CUF is characterized as having poor to fair shoreline aquatic

habitat with no aquatic macrophytes. The fish community consists of warmwater species with a mix of species typical of both rivers and reservoirs due to the CUF proximity to the main stem of Lake Barkley and more riverine conditions near the CUF (TVA 2016a).

Wells Creek is a small tributary of the Cumberland River that flows south-north through the central portion of the CUF property. Scott Branch is a tributary of Wells Creek that flows west-east through the property. An unnamed intermittent stream (tributary to Scott Branch) flows through the middle of the proposed landfill site. The lower reach of this stream near its confluence to Scott Branch has flowing water. The upper reach of this stream is dry during parts of the year and only experiences water flows during wet weather. Due to their proximity and connection to the Cumberland River, species composition is expected to be similar to that described above for the Cumberland River.

TVA has used a Reservoir Ecological Health monitoring program since 1990 to evaluate ecological conditions in Lake Barkley in support of continuance of the 316(a) thermal variance for the CUF discharge. A component of this monitoring program is a multi-metric approach to data evaluation for fish communities known as the Reservoir Fish Assemblage Index (RFAI). Fish communities are used to evaluate ecological conditions because of their importance in the aquatic food web and because fish life cycles are long enough to integrate conditions over time. Benthic (bottom dwelling) macroinvertebrate populations are assessed using the Reservoir Benthic Index (RBI) methodology. Because benthic macroinvertebrates are relatively immobile, negative effects to aquatic ecosystems can be detected earlier in benthic macroinvertebrate communities than in fish communities. A component of this monitoring program includes sampling the benthic macroinvertebrate community (TVA 2016a).

TVA sampled fish upstream and downstream of CUF between RM 102 and 107 in the spring, summer, and autumn of 2015. Upstream of CUF, 1,576 fish (34 species) were collected in Spring 2015, 753 fish (32 species) were collected in Summer 2015, and 597 fish (37 species) were collected in Autumn 2015. Typical species upstream of CUF included gizzard shad, spotfin shiner, emerald shiner, yellow bass, bluegill, longear sunfish, and largemouth bass (downstream of CUF). 1,643 fish (32 species) were collected in Spring 2015, 604 fish (27 species) were collected in Summer 2015, and 705 fish (31 species) were collected in Autumn 2015. Typical species downstream of CUF included threadfin shad, longear sunfish, emerald shiner, largemouth bass, bluegill, gizzard shad, and yellow bass. Ecological health ratings were similar for both the upstream and downstream sites for all three seasons, ranging from fair to good (TVA 2016a).

As part of the same TVA 2015 study on the Cumberland River near CUF between RM 102 and 106.6, benthic (or bottom-dwelling) invertebrates were also collected. Oligochaetes, chironomids, and Asiatic clams (*Corbicula* spp.) were the dominant taxa both upstream and downstream of CUF. Ecological health ratings were similar between the upstream and downstream sites for all three seasons, ranging from fair to good (TVA 2016a).

A 2011 mussel survey conducted to characterize the freshwater mollusk community on the Cumberland River (spot dives) and Wells Creek (along sampling transects) near CUF found low abundances of a small number of relatively common mussel species. The three most numerous freshwater mussel species included winged mapleleaf, wartyback, and pink heelsplitter. On the Cumberland River, 24 mussels were collected from 23 locations (Catch per unit effort = 9 mussels/hour). On Wells Creek, 11 mussels were collected along four transect locations (density = 0.05 mussels/square meter) (Third Rock Consultants 2011). Results of the study also demonstrated that river substrates were categorized as degraded/sub-optimal in the study area

with clay as the dominant substrate overlain by silt (Third Rock Consultants 2011; TVA 2020b). Protected mussel species (described further in Section 3.8.4) have not been collected in the area in decades and TVA has concluded that they no longer occur in the vicinity of CUF.

3.8.3.1.2. Alternative A

3.8.3.1.2.1. Proposed CC Plant

Field surveys conducted during July and August 2021 identified two perennial streams, five ephemeral channels, and two ponds on the A2 Site (Figure 3.6-1). Streams were surveyed during a period of drought conditions; however, fish were present and therefore indicate a permanence of hydrological conditions. Secondary indicators taken during the hydrologic determination note moderate to strong continuous bed and bank present, moderately sinuous channel with in-channel structure, presence of organic debris lines or piles, and macrobenthos present (specifically, mayfly), and growth of filamentous algae in one of the two streams. One of the streams was noted to be impacted by cattle access. These unnamed tributaries were not listed in the TDEC 303(d) streams list (TDEC 2020, TDEC 2022). The proposed transmission lines associated with the CC plant would be constructed within the CUF Reservation; therefore, streams and aquatic life associated with Scott Branch and Wells Creek described in Section 3.8.3.1.1 would be a part of this affected environment.

3.8.3.1.2.2. Natural Gas Pipeline Corridor

As described in Section 3.6.2.1.2.2, surveys for surface waters from June 2021 to April 2022 identified 149 waterbodies within the pipeline corridor that may support aquatic life, including 35 intermittent streams, 35 perennial streams, and no ponds (TGP 2022b). While surveys also identified 79 ephemeral channel crossings, these flow only in direct response to precipitation runoff in their immediate locality and do not contain the hydrological and biological conditions to support fish or multiple populations of obligate lotic aquatic organisms whose life cycle includes an aquatic phase of at least two months (TDEC 2019b). All streams in the corridor are warmwater streams and classified for fish and aquatic life designated uses. Warmwater streams and rivers in the area are typically slower-moving bodies of water with shifting gravel/sand or bedrock substrates and are less oxygenated compared to coldwater streams and rivers. As part of the fish and aquatic life designated use, the streams must meet certain criteria pertaining to water quality (dissolved oxygen, temperature, turbidity, metals and toxic substances, nutrients, coliform, etc.), biological integrity, flow, and habitat (TDEC 2019b). Stream habitat “shall provide for the development of a diverse aquatic community that meets regionally-based biological integrity goals” (TDEC 2019b). Therefore, many of these streams may contain aquatic life such as fish and invertebrates if they have supportive flow.

Warmwater lakes and rivers in Tennessee are stocked with bass, catfish, sturgeon, and walleye by the TWRA. The nearest TWRA fish stocking location is approximately 6.5 miles to the southeast along the Harpeth River near Kingston Springs, Tennessee (TWRA 2022; TGP 2022c). Four species of introduced Asian carp (bighead, silver, black, and grass carp) are also known to occur in creeks and streams in Tennessee (TGP 2022c) and therefore may be present in the area.

Mussels surveys were conducted in September 2021 by Dinkins Biological Consulting, LLC., in streams crossed by the natural gas pipeline corridor (TGP 2022c). Only one relic shell of painted creekshell (*Villosa taeniata*) was identified. The streams at the survey sites primarily consisted of either shifting gravel/sand or bedrock, which is not preferred mussel habitat.

3.8.3.1.3. Alternative B

3.8.3.1.3.1. Johnsonville Reservation

The JCT Reservation is located on the east bank of the Kentucky Reservoir of the Tennessee River. The proposed location for the CT plant is in previously developed portions of the reservation and does not contain waterbodies with aquatic life.

3.8.3.1.3.2. Gleason Reservation

The proposed Gleason CT plant site occurs within the Southeastern Plains ecoregion. Streams in this ecoregion typically are characterized by slightly elevated gradient with sandy substrates (Etnier and Starnes 1993). Extensive agricultural practices over the past several decades have resulted in the Obion River and surrounding tributaries being extensively channelized, resulting in little natural habitat for aquatic species. The nearby Middle Fork Obion River is currently listed on the TDEC 303(d) list as “not supporting” for failing biocriteria (TDEC 2008). Based on the NHD, one intermittent stream crosses the Gleason Reservation and ultimately flows to the Middle Fork Obion River (Figure 3.6-4). Approximately 1,618 lf of this intermittent stream is on the potential CT plant site. Aquatic life requiring perennial flow (such as fish or bivalves) is unlikely to be present; however, other organisms able to tolerate intermittent flow regimes may use the stream channel as habitat, such as crayfish, amphibians, and benthic macroinvertebrates.

3.8.3.1.3.3. Transmission Corridors

A desktop review of the proposed 40-mile-long transmission line corridor identified eight streams and tributaries in the vicinity. These include Chestnut Branch, North Fork Obion River, East Fork Clarks River, Holly Fork Creek, Cane Creek, Little Cane Creek, Mayo Branch, and Cypress Creek. While aquatic life data is not available for these streams, none of the streams are listed as impaired.

3.8.3.1.4. Alternative C

3.8.3.1.4.1. Middle Tennessee TVA Power Service Area

The Middle Tennessee region consists primarily of the Tennessee River and Cumberland River drainages (see Section 3.6.1.2.5.1). These river systems support a large variety of freshwater fishes and invertebrates (including freshwater mussels, snails, crayfish, and insects). Due to the presence of several major river systems, the region’s high geologic diversity and the lack of glaciation, the region is recognized as a globally important area for freshwater biodiversity (Stein et al. 2000).

3.8.3.2. Environmental Consequences

3.8.3.2.1. The No Action Alternative

Under the No Action Alternative, TVA would continue current plant operations. TVA would implement all of the planned actions related to the current and future management and storage of CCRs. Continued short-term, direct, and negligible effects on fish eggs, fish larvae, and fish are expected from entrainment and impingement; however, the severity of these effects would be dependent upon the frequency of operations. The No Action Alternative would result in no change to current aquatic ecology conditions; as a result, no project-related environmental effects with respect to aquatic ecosystems would occur under this alternative.

3.8.3.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Although watercourses occur on the CUF Reservation, retirement, decommissioning, deactivation, decontamination, and deconstruction ground disturbance activities would be

minimized, and all work would be done in accordance with state and local BMPs. With proper implementation of BMPs, no direct effects to the aquatic communities that may be present in watercourses within the project area are anticipated. All necessary CWA Section 404 and TDEC permits would be obtained for in-water work, such as the demolition and removal of intake structure equipment and mooring cells.

There is a possibility that aquatic ecology could be indirectly affected due to modification of the riparian zone by stormwater runoff resulting from construction activities associated with selective demolition. Potential effects due to removal of vegetation within the riparian zone include increased erosion and siltation, loss of habitat, and increased temperatures. Construction activities associated with the removal of buildings, as well as backfilling facilities, could lead to increased siltation and runoff in the Cumberland River. With appropriate BMPs implemented during construction, operation, and maintenance of the proposed construction activities, any effects to aquatic ecology resulting from the proposed action would be insignificant.

The retirement of CUF would result in elimination of entrainment and impingement mortality of fish and shellfish in the vicinity of the CUF cooling water intake structure. Thermal discharges would also cease, generally improving water quality. Based on annual biomonitoring of the fish community as a condition of CWA Section 316(a), effects from CUF on fish populations in the vicinity of the plant are negligible, as the Cumberland River maintains a balanced and indigenous fish community as demonstrated through analysis of fish community diversity, trophic levels, limited presence of pollution-tolerant species, and representation of indigenous species. Some species, such as introduced subtropical species like threadfin shad, may depend on heated effluent, and the absence of thermal discharges during winter could result in fish kills of this or similar sensitive species. However, overall, the retirement of CUF is unlikely to result in a substantial change to the aquatic community. Cumulative effects to aquatic life are not anticipated.

3.8.3.2.2.1. Environmental Justice Considerations

Effects to aquatic life, including potential subsistence resources for EJ populations, due to CUF retirement and D4 activities would be minor to minimized or mitigated and generally reduced in comparison to existing conditions. Thus, overall, there may be slight beneficial effects to human populations utilizing these resources, while those utilizing aquatic life that depend on the heated effluent may have slight negative effects. These minor to minimal adverse effects on EJ populations could be amplified due to the likelihood that the reliance on these resources is more critical to or are long-term cultural practices of these low-income and minority populations.

3.8.3.2.3. Alternative A

3.8.3.2.3.1. Construction and Operation of CC Plant at CUF

The only aquatic resources located with the impact footprint for the proposed CC plant are ephemeral channels and an isolated pond. The ephemeral channels do not provide habitat for aquatic life or anthropogenic uses (e.g., water withdrawals); however, the isolated pond may provide habitat for amphibians or invertebrates, such as dragonfly larvae, which would be lost. The proposed CC plant would use air-cooled condensers, eliminating the need for water withdrawals[22] from the nearby Cumberland River and minimizing effects to aquatic life. Some water treatment may be required to support the CC plant, which may result in upgrades to the

[22] Water withdrawals would continue to be required for continued operation of the remaining unit at CUF until such time that the unit is retired.

water treatment plant. The facility would require potable water, which would be obtained from the existing City of Erin Water Department public supply to the CUF Reservation.

Upgrades to the barge unloading area could temporarily impact aquatic life in the immediate vicinity due to short-term turbidity and/or noise disturbances. Upgrades to the barge unloading area would be permitted in accordance with the CWA Section 404/401 and Section 10 regulations and would adhere to BMPs outlined in TVA's BMP manual.

Construction of a new switchyard at the CC plant and connecting two 500-kV TLs to existing TL ROW would result in negligible effects to aquatic life. Streams within or near the TL corridors or intersected by access roads have the potential to be impacted from surface water runoff increasing siltation to those receiving waters. Ground disturbance would be minimized, and all work would be conducted in accordance with BMPs outlined in TVA's BMP manual (TVA 2017a). Therefore, effects to the aquatic ecology of streams from the TL construction and operation would be minor and insignificant. Furthermore, applicable CWA Section 404 and 401 permits would be obtained from USACE for any stream alterations resulting from TL construction, and application of the terms and conditions of these permits would minimize these effects. As such, cumulative effects to aquatic life are not anticipated.

3.8.3.2.3.2. Construction and Operation of Natural Gas Pipeline

Aquatic life would be affected either directly by the alteration of habitat conditions within riverine habitat, streams, wetlands, and other water bodies or indirectly due to modification of the riparian zone and storm water runoff resulting from construction of the proposed pipeline. During the construction of the pipeline, surface water effects are likely to occur from trenching the pipeline. Horizontal directional drilling (HDD) would be used at the pipeline crossings under Yellow Creek (an associated unnamed tributary), Jones Creek, and Wells Creek] to minimize effects to aquatic life. The remaining stream crossings would be constructed by dry open cut, as described in Section 3.6.2.2.3. Erosion and sediment control BMPs would also be deployed to minimize the potential for aquatic life effects.

Construction occurring within streams poses potential for impacts on fish habitat and water quality (TGP 2022c). "Downstream habitat alteration and increased suspended solids concentrations and sedimentation may eliminate or degrade fish spawning, nursery areas, and other habitats, resulting in a temporary reduction in reproductive potential. These impacts are typically temporary in nature as the sediments are flushed during subsequent storm events and aquatic communities re-colonize the affected area" (TGP 2022c).

The natural gas pipeline corridor crosses only warmwater streams (TGP 2022c). TWRA recommends that, if potential habitat for the state endangered and threatened fish species is observed within the Project area, instream work be restricted from April 1 through June 30. TGP is requesting confirmation from TWRA that time-of-year restrictions are not applicable for this Project. In April 2022, TWRA requested additional information on water crossing methodology, which TGP provided by letter dated July 15, 2022.

During construction, TGP would implement the FERC Plan and FERC Procedures (with approved deviations) and as incorporated into the Project's ECMP. The FERC Plan and FERC Procedures (with approved deviations) include appropriate BMPs to avoid, minimize, and mitigate for potential impacts during wetland and waterbody crossings. BMPs such as turbidity curtains may be deployed where necessary to limit downstream sedimentation. Disturbed areas would be restored by TGP to pre-construction conditions and stabilized to minimize erosion and sedimentation (TGP 2022c).

As stated in Resource Report 3 (TGP 2022c):

> TGP intends to install temporary waterbody bridges across creeks along several access roads, as needed, to allow access for construction equipment. Depending upon streamflow at the time of construction, the temporary waterbody bridge types installed could be rockfill and flume, portable, portable with culvert support, timber mat, or flexi-float bridges.
>
> […] Post-construction operational impacts on water quality would be minimal. Restoration and maintenance of the vegetation within the pipeline ROW would minimize the erosion potential relative to each stream crossing by the pipeline. Removal of mature streamside trees and vegetation at the stream crossings would temporarily reduce shading of the stream, eliminate escape cover, and potentially result in a locally elevated water temperature. Elevated water temperature may lead to a reduction in levels of dissolved oxygen and influence fish survival and fitness. However, following construction of the [pipeline] and restoration/stabilization of the ROW, TGP would limit vegetation maintenance of the permanent ROW to a 10-foot-wide corridor centered over the pipeline within wetlands and across waterbodies, except for selectively cutting trees that are located within 15 feet of the pipeline with roots that could compromise the integrity of the pipeline coating. This would allow for the re-establishment of shrubs and herbaceous species along the stream banks that would provide needed shading and crucial cover habitat to maintain fishery habitat characteristics. Similarly, during ROW vegetation maintenance activities, TGP would comply with the FERC Procedures (with [approved] deviations), incorporated in the Project's ECMP, and would leave vegetation in place within 25 feet of waterbodies, as measured from the waterbody's high-water mark, to retain a riparian strip. Vegetation maintenance within this 25-foot riparian strip would be limited to the 10-foot-wide corridor centered over the pipeline centerline as necessary for temporary equipment crossings, emergency access, and the removal of trees located within 15 feet of the pipeline with roots that could compromise the integrity of the pipeline coating.
>
> All waterbodies crossed by the [pipeline] or within the construction workspace would be protected by adherence to the FERC Plan and FERC Procedures (FERC 2013a, 2013b). […] BMPs to protect and minimize potential adverse impacts on [aquatic resources] include:
>
> - installing the pipeline as quickly and efficiently as possible and limiting the amount of equipment and activities in waterbodies;
> - coordinating construction activities to avoid high flow and spawning periods;
> - installing erosion controls to prevent sediment and siltation from entering streams;
> - preventing runoff from entering waterbodies;
> - constructing waterbody crossings as perpendicular to the axis of the waterbody channel as engineering and routing conditions allow;
> - maintaining ambient downstream flow rates;

- removing construction material and structures from the waterbodies after construction activities are completed;
- restoring stream channels and bottoms to their original configurations and contours;
- permanently stabilizing stream banks and adjacent upland areas after construction activities are completed;
- inspecting the ROW regularly during and after construction and repairing any erosion and/or performing restoration, as needed, in a timely manner; and
- reducing the amount of clearing and maintaining existing vegetation in place on stream banks to the extent practicable.

TGP determined that cumulative effects to aquatic life may occur with past/present and RFFA actions in proximity to the proposed pipeline but would be minimized through the use of BMPs. The CIAA for cumulative impacts on aquatic life is the HUC-12 area in which the pipeline facilities are located. The HUC-12 watersheds crossed by the pipeline corridor include:

- Lower Jones Creek (51302040503);
- Outlet Harpeth River (51302040606);
- Trace Creek-Harpeth River (51302040605);
- Furnace Creek (51302050101);
- Upper Bartons Creek (51302050102);
- Lower Bartons Creek (51302050104);
- Lower Yellow Creek (51302050203);
- Outlet Yellow Creek (51302050205);
- Johnson Creek-Cumberland River (51302050302);
- Guices Creek (51302050401); and
- Wells Creek (51302050402

No permanent impacts on aquatic life would result from the pipeline construction and operation. Potential temporary impacts on aquatic life “take two primary forms: (1) direct impacts from construction activities through waterbodies; and (2) indirect impacts from nearby construction activities. No direct impact on [aquatic life] is anticipated relative to the timing of construction. In accordance with the FERC Procedures (with [approved] deviations), incorporated into the Project’s ECMP, TGP has consulted with the USFWS regarding federally protected aquatic species and TWRA relative to timing restrictions [associated with sensitive aquatic life].

As detailed in TGP’s Resource Report 3 (TGP 2022c):

> Because these potential impacts would result in only short-term, localized increases in turbidity levels and downstream sediment deposition in the waterbodies crossed, only those actions occurring during the same timeframe as the proposed [pipeline] and within the same HUC 12 watersheds as the [pipeline]

> would be likely to have a cumulative impact. […] In April 2022, TWRA requested additional information on water crossing methodology. TGP responded to TWRA's additional information by letter dated July 15, 2022. TGP will provide FERC with a copy of TWRA's response letter when received. TGP received confirmation from TWRA that time-of-year restrictions are not applicable.
>
> A small number of actions were identified that may impact the same HUC-12 watersheds as the proposed natural gas pipeline corridor. However, these actions are not proposed during the same timeframe as this project and therefore would not result in a cumulative impact. Further, like the proposed pipeline, any action would require minimization and mitigation measures for impacts on waterways. As a result of these requirements and the lack of actions proposed within the same HUC-12 watershed during the same timeframe as the natural gas pipeline corridor, cumulative impacts on aquatic life resulting from construction-related erosion and sedimentation are not anticipated.

TVA has reviewed and concurs with TGP's conclusions on potential project-related effects to aquatic life from the construction of the natural gas pipeline.

3.8.3.2.3.3. Summary of Alternative A

No impacts would occur to aquatic life due to the construction of the CC plant, temporary construction support and laydown areas, or switchyard. No direct impacts to aquatic resources would be made from the transmission lines. Streams within or near the transmission line corridors have potential to be impacted by surface water runoff increasing siltation; however, appropriate BMPs, including sediment and erosion control devices, such as silt fencing, would be installed to prevent and minimize risk to surface waters from construction activities.

Upgrades to the barge facility would result in permanent impacts to approximately 250 lf of shoreline along the Cumberland River. Given the size of the Cumberland River, it is unlikely that this area provides resources that could not be found by aquatic life in nearby areas. Temporary impacts would include temporary turbidity and noise disturbances during upgrades construction. Impacts would be minimized through the applicable permitting process and adherence to BMPs outlined in TVA's BMP manual.

No permanent impacts would be made to aquatic resources containing aquatic life from the natural gas pipeline lateral. Temporary impacts would occur to 2,736 lf of perennial stream channel as a result of pipeline installation (dry open cut). Streams would be returned to original grade following installation of the pipeline.

There would be no long-term impacts to surface waters, and therefore aquatic life, associated with the Alternative A CC plant or natural gas pipeline.

3.8.3.2.3.4. Environmental Justice Considerations

Effects to aquatic life as a result of the natural gas pipeline lateral are in areas with higher percentages EJ populations than non-EJ populations (seven out of 10 census block groups are low-income EJ populations in the pipeline lateral EJ study area). If effects to aquatic life occur, these could in turn affect EJ populations that currently fish the affected waters. Recreational activities such as fishing are known to occur within five miles of the Lake Barkley Recreation Area or Cross Creeks National Wildlife Refuge (see Section 3.9 for more details on these areas; USACE 2022a and USFWS 2022a). While such activities likely occur among both EJ and non-

EJ populations, the effects could be amplified on low-income and minority populations due to the potential for greater reliance on subsistence resources.

3.8.3.2.4. Alternative B

3.8.3.2.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Construction of the CT plant would occur on previously developed land and would result in no effects to aquatic life. BMPs would be installed along the adjacent reservoir shoreline to minimize erosion and subsequent sedimentation. With the implementation of BMPs, effects to aquatic life in the local surface waters are not expected. No water withdrawals would be needed for operation of the CT plant. Cumulative effects to aquatic life would not occur.

3.8.3.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

Construction of the CT plant has the potential to affect one intermittent stream. Aquatic life would be affected by the proposed action either directly by the alteration of habitat conditions within the stream or indirectly due to modification of the riparian zone and storm water runoff resulting from construction and maintenance activities. The CT plant would be sited to avoid and/or minimize effects to the streams as practicable. Cumulative effects to aquatic life would not occur.

3.8.3.2.4.3. Transmission and Other Components

The 40-mile transmission line that would be needed for Alternative B would cross surface waters, including Chestnut Branch, North Fork Obion River, East Fork Clarks River, Holly Fork Creek, Cane Creek, Little Cane Creek, Mayo Branch, Cypress Creek, and likely unnamed streams. As stated in Section 3.6.2.2.4.3, there are an estimated 2.9 stream crossings per mile of new transmission line (with a range of 0 to 50 crossings) based on typical effects described in Table 3.3-1; for the 40-mile transmission line, this equates to an average of 116 stream crossings (range 0 to 2,000). To minimize effects to aquatic life, TVA would avoid placing structures within surface waters, and effects would be minimized by crossing surface waters at a perpendicular angle where practicable. Erosion and sediment control BMPs would be deployed and USACE and TDEC permits would be obtained. Permanent stream crossings that cannot be avoided would be designed to not impede runoff patterns and the natural movement of aquatic fauna. Temporary stream crossings and other construction and maintenance activities associated with the TLs would comply with appropriate state permit requirements and TVA requirements as described in TVA's BMP manual (TVA 2017a).

3.8.3.2.5. Alternative C

3.8.3.2.5.1. Construction and Operation of Solar and Storage Facilities

Alternative C would result in construction activities that have the potential to permanently affect streams and/or temporarily affect aquatic life via stormwater runoff. As noted in Table 3.2-1, TVA has evaluated typical effects associated with the development of solar facilities. Estimates of an average 8.7 lf of stream effect per MW average would result in approximately 26,100 lf of stream effects for the 3,000 MW of solar facilities. Effects on streams would be spread across multiple solar sites. Cumulative effects to aquatic life would occur; combined with future expansion of solar additions by 2030s forecasted in TVA's 2019 IRP, an additional 87,000 lf of stream effects could occur.

On-site surveys of aquatic resources and appropriate permitting (and mitigation) prior to land disturbance activities would be completed. Forested stream effects are typically avoided. TVA and solar developers would minimize effects to aquatic life by siting facilities on lands with few surface water resources, configuring the solar arrays, access roads, and other infrastructure to

avoid surface waters, and maintaining vegetated buffers along surface waters. BESS sites are typically small enough to be sited to avoid surface water and aquatic life effects.

Appropriate BMPs would be installed, and all proposed project activities would be conducted in a manner to ensure that waste materials are contained, and the introduction of pollution materials to the receiving waters would be minimized.

3.8.3.2.5.2. Transmission and Other Components

As noted in Table 3.3-1, transmission lines typically result in an average of 2.9 stream crossings per mile of new line. Based on TVA's evaluation, an average of 1.7 miles of new transmission line are needed for solar facilities, which indicates that approximately 5 surface water crossings may occur for each facility. Based on the assumption of thirty 100 MW solar sites, approximately 150 surface water crossings would occur. To minimize effects to aquatic life, TVA would avoid placing structures within surface waters, and effects would be minimized by crossing surface waters at a perpendicular angle where practicable. Erosion and sediment control BMPs would be deployed and USACE and TDEC permits would be obtained. Cumulative effects to aquatic life would occur as a result of transmission lines associated with TVA's expansion of solar facilities in the 2019 IRP but would be minor with implementation of BMPs.

3.8.4. Threatened and Endangered Species

Some species of plants and animals are protected under the ESA and related state laws. The ESA was implemented to provide a framework to conserve and protect threatened and endangered species and their habitats. This act authorized the determination and listing of species as endangered and threatened; prohibited unauthorized taking, possession, sale, and transport of endangered species, provided authority to acquire land for the conservation of listed species, and authorized civil and criminal penalties for violating the ESA (among other authorizations). An endangered species is defined by the ESA as any species in danger of extinction throughout all or a significant portion of its range. Likewise, a threatened species is likely to become endangered within the foreseeable future throughout all or a significant part of its range. Critical habitats, essential to the conservation of listed species, also can be designated under the ESA. The ESA establishes programs to conserve and recover endangered and threatened species and makes their conservation a priority for federal agencies. Under Section 7 of the ESA, federal agencies are required to consider the potential effects of their proposed action on endangered and threatened species and critical habitats. If the proposed action has the potential to affect these resources, the federal agency is required to consult with the USFWS.

Fish and game species are also protected by the hunting, fish, and trapping regulations enforced by the TWRA and the USFWS. In addition to these laws, the Migratory Bird Treaty Act (MBTA) of 1918, the Bald and Golden Eagle Protection Act (BGEPA) of 1940, and EO 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds also provide protection to birds. The MBTA and EO 13186 address protection of most native birds occurring in the U.S. The MBTA makes the purposeful taking, killing, or possession of migratory birds, their eggs, or nests unlawful, except as authorized under a valid permit. EO 13186 focuses on federal agencies taking actions with the potential to have negative effects on populations of migratory birds. It provides broad guidelines on avian conservation responsibilities and requires agencies whose actions affect or could affect migratory bird populations to evaluate those effects and implement practices to minimize, to the extent practicable, adverse effects on migratory bird resources. TVA is currently developing a Memorandum of Agreement with USFWS under EO 13186.

There are several laws, in addition to the ESA, and Executive Orders established for the protection of plant species and communities. The Rare Plant Protection and Conservation Act of 1985 authorized the state of Tennessee to legally list plants as threatened, endangered, and of special concern (TDEC, n.d.). The Act also authorized the Tennessee Department of Environment and Conservation to enter into a cooperative agreement with the USFWS 'with respect to programs designed to conserve rare plants,' that establishes the Division of Natural Areas as the lead state agency in the process of listing and recovery efforts for federally endangered or threatened species of plants.

A desktop review of the USFWS Information for Planning and Consultation (IPaC) tool, the TDEC rare species list, and the TVA Regional Natural Heritage Database (RNHD) for species of conservation concern potentially present within the project areas for the No Action and each of the Action Alternatives was conducted, including the pipeline corridor under Alternative A and both sites under Alternative B. Field surveys of the CUF Reservation were also conducted by TVA from June to August 2021 (TVA 2021h) to assess the potential for the presence of threatened and endangered species. Alterative site boundaries for CUF, JCT, and Gleason Reservations were used for the IPaC database. The USFWS issued a letter of concurrence on July 20, 2022, and an acknowledgement of minor scope changes on August 26, 2022, based on the proposed actions and the potential impact to ESA listed species generated in the IPaC database under action alternative A (Appendix K).

TDEC rare species lists are reported on a county-wide basis, and therefore species were listed for each county for each alternative. Information derived from the RNHD was reported from within five miles of the site for plant species, at the county level and the ten-digit Hydrologic Code Unit (HUC) for aquatic species, and within three miles for terrestrial species. TGP has conducted field surveys of the pipeline corridor as part of the Environmental Report which TVA draws upon for this analysis. Species surveys would be conducted as part of a supplemental USFWS consultation if Alternative B or C are selected as the preferred alternative. Species identified from queries of the USFWS IPaC, TDEC, and TVA RNHD are included in Table 3.8-6.

Table 3.8-6. Species of Conservation Concern resulting from data queries for each Action Alternative

Common and Scientific Name	Cumberland (CUF) Reservation	Johnsonville (JCT) Reservation	Gleason Reservation	Habitat	Potential Habitat Presence		
					CUF	JCT	Gleason
Bird							
Bewick's wren *(Thryomanes bewickii)*	SD	SD		Prefer brushy areas, thickets and scrub in open country.	X		
Bald eagle* *(Haliaeetus leucocephalus)*	SD+	SD		Nests in tall, mature trees near large bodies of water such as large rivers, lakes, reservoirs, and coastal areas	X		
Cerulean warbler *(Setophaga cerulea)*	SD			Found in mature deciduous forest, particularly in floodplains or mesic conditions.	X		
Golden eagle* *(Aquila chrysaetos)*	SD			In their winter habitat in the eastern United States, they are found in heavily forested terrain, but most golden eagles prefer open areas of deserts, mountains, plateaus, and steppes where cliffs or tall forests alternate with open spaces.	X		
Henslow's sparrow *(Ammodramus henslowii)*	ST			Damp open fields and meadows with grass interspersed with weeds or shrubs.	X		
Little blue heron *(Egretta caerulea)*		SD		Roost in trees and shrubs near water; forage for insects in wetlands and lakes. Colony observed on an island in Kentucky Reservoir.			
Osprey *(Pandion haliaetus)*	SR+	SR+		Found on rivers, lakes, reservoirs, lagoons, swamps, and marshes where fish are abundant.	X	X	
Piping plover *(Charadrius melodus)*		FT, ST		Forage in exposed sand flats, mudflats, sandy beaches, stream shorelines, and ephemeral ponds. Rare fall and spring migrants in the TN Valley region. Species has been documented foraging on mudflats in Kentucky Reservoir.		X	
Swainson's warbler *(Limnothlypis swainsonii)*	SD		SD	Mature, rich, damp, deciduous floodplain and swamp forests with thick understory.	X		

Common and Scientific Name	Cumberland (CUF) Reservation	Johnsonville (JCT) Reservation	Gleason Reservation	Habitat	Potential Habitat Presence		
					CUF	JCT	Gleason
Mammal							
Allegheny woodrat *(Neotoma magister)*		SD		Rock outcrops, cliffs, talus slopes, crevices			
Gray bat *(Myotis grisescens)*	FE, SE	FE, SE		Roosts in caves or karst features year-round. Various foraging habitats including wet meadows, ponds, streams, and wetlands	X		
Indiana bat *(Myotis sodalis)*	FE, SE	FE, SE	FE, SE	Various roosting habitats including trees with exfoliating bark, caves and mines. Various foraging habitats including forests, wetlands, streams, and ponds.	X		X
Northern long-eared bat *(Myotis septentrionalis)*	FT, ST	FT, ST	FT, ST	Various roosting habitats including trees with exfoliating bark, caves and mines. Various foraging habitats including forests, wetlands, streams, and ponds.	X		X
Rafinesque's big-eared bat *(Corynorhinus rafinesquei)*			SD	Caves, hollow trees, abandoned buildings; often associated with forested areas.	X		X
Tricolored bat *(Perimyotis subflavus)*	FPE, ST+			Hibernates in caves, rock crevices and mines. Summer roosts include trees, cliffs, and sometimes buildings.	X		
Southern bog lemming *(Synaptomys cooperi)*			SD	Marshy meadows, wet balds, & rich upland forests.			
Reptile							
Alligator snapping turtle *(Macrochelys temminckii)*	FPT, ST	ST		Slow moving, deep waters of large rivers, sloughs, oxbows, swamps and lakes	X		
Northern pinesnake *(Pituophis melanoleucus)*	ST	ST		Well-drained sandy soils in pine/pine-oak woods; dry mountain ridges			
Western pygmy rattlesnake *(Sistrurus miliarius streckeri)*	ST			Water in river floodplains, swamps, marshes, and wet prairies; occasionally drier wooded uplands	X		

Common and Scientific Name	Cumberland (CUF) Reservation	Johnsonville (JCT) Reservation	Gleason Reservation	Habitat	Potential Habitat Presence		
					CUF	JCT	Gleason
Amphibians							
Hellbender *(Cryptobranchus alleganiensis)*	SE	SE		Clean and flowing water with plenty of oxygen in large streams and creeks. Areas with gravel bottoms and an abundance of rocks and submerged logs are necessary			
Fish							
Blue sucker *(Cycleptus elongatus)*	ST	ST		Swift waters over firm substrates in big rivers.	X		
Coppercheek darter *(Nothonotus aquali)*		ST		Only known to occur from the Duck River system of Tennessee. Occurs in small to medium rivers where it occurs in rocky riffles with clear, fast-flowing water.			
Firebelly darter *(Etheostoma pyrrhogaster)*			SD	Sand- and gravel-bottomed pools of headwaters, creeks, and small rivers; upper Coastal Plain in Obion River watershed; west Tennessee.			
Highfin carpsucker *(Carpiodes velifer)*		SD		Large rivers, mostly in Tennessee River drainage.			
Lake sturgeon *(Acipenser fulvescens)*	SE			Bottoms of large, clean rivers and lakes.	X		
Piebald madtom *(Noturus gladiator)*			SD	Large creeks and rivers in moderate-swift currents with clean sand or gravel substrates; Mississippi River tributaries.			
Pygmy madtom *(Noturus stanauli)*		FE, SE	FE, SE	Only occurs the Clinch River and the Duck River in Humphreys County. The preferred habitat includes gravel runs of clear, medium-sized rivers.			
Saddled madtom *(Noturus fasciatus)*		ST		Occurs in the Duck River system and nearby tributaries of the Tennessee River in Hardin and Wayne Counties, Tennessee. The preferred habitat includes rocky riffles, runs and flowing pools of clear creeks and small rivers			

Common and Scientific Name	Cumberland (CUF) Reservation	Johnsonville (JCT) Reservation	Gleason Reservation	Habitat	Potential Habitat Presence		
					CUF	JCT	Gleason
Slenderhead darter *(Percina phoxocephala)*		SD		Small-large rivers with moderate gradient in shoal areas with moderate-swift currents; portions of Tennessee and Cumberland river watersheds.			
Tennessee logperch *(Percina apina)*		SD		Duck River system and Whiteoak Creek; currently restricted to the Western Highland Rim.			
Crustaceans							
Hatchie burrowing crayfish *(Creaserinus hortoni)*			SE	Primary burrower; uses saturated or seasonally saturated soils associated with permanent bodies of water			X
Mollusks							
Clubshell *(Pleurobema clava)*		FE, SE	FE, SE	Small to medium sized rivers and streams with sand and fine gravel substrates or in clean, coarse sand and gravel runs			
Orangefoot pimpleback [pearlymussel] *(Plethobasus cooperianus)*		FE, SE	FE, SE	Perennial streams with rocky areas and swift to slow moving currents			
Pink mucket *(Lampsilis abrupta)*	FE, SE	FE, SE	SE	Large rivers with sand-gravel or rocky substrates with moderate to strong currents	X		
Rabbitsfoot *(Theliderma cylindrica)*	FT, ST	FT, ST	FT, ST	Large rivers with sand and gravel	X		
Ring pink *(Obovaria retusa)*		FE, SE	FE, SE	Large rivers in sand and gravel.			
Rough pigtoe *(Pleurobema plenum)*		FE, SE	FE, SE	Medium to large sized rivers, in substrates ranging from mud and sand to gravel, cobble, and boulders			
Slabside pearlymussel *(Pleuronaia dolabelloides)*		FE, SE	FE, SE	Large creek to moderately sized rivers. Generally observed in gravel substrates within interstitial sand, with moderate current.			
Spectaclecase *(Cumberlandia monodonta)*		FE, SE	FE, SE	Medium to large rivers; in substrates ranging from mud and sand to gravel, cobble, and boulders			

Common and Scientific Name	Cumberland (CUF) Reservation	Johnsonville (JCT) Reservation	Gleason Reservation	Habitat	Potential Habitat Presence		
					CUF	JCT	Gleason
Tan Riffleshell *(Epioblasma florentina walkeri)*				Headwaters, riffles, and shoals in sand and gravel substrates			
Plants							
American ginseng *(Panax quinquefolius)*	SSC+	SSC		Rich woods; identified during 2021 field surveys in dry deciduous woods	X		
Bearded rattlesnake-root *(Prenanthes barbata)*	SSC	SSC		Barrens and dry woodlands	X		
Blue mud-plantain *(Heteranthera limosa)*	ST	ST		Mud flats			
Blue sage *(Salvia azurea var. grandiflora)*	SSC			Barrens			
Bristly sedge *(Carex comosa)*	ST			Swamps	X		
Butternut *(Juglans cinerea)*	ST			Rich woods and hollows	X		
Cow-parsnip *(Heracleum maximum)*	SSC			Moist woods and floodplains	X		
Cream wild-indigo *(Baptisia bracteata var. leucophaea)*	SSC			Dry oak woods and barrens	X		
Duck River bladderpod *(Paysonia densipila)*				Open limestone glades, disturbed lowlands along river and stream bottoms			
Eggert's sunflower *(Helianthus eggertii)*				Rocky, open oak-hickory woodlands and barrens on well drained soils			
Fen orchis *(Liparis loeselii)*	ST			Calcareous seeps			
Fraser's loosestrife *(Lysimachia fraseri)*	SE			Dry open woods	X		

Common and Scientific Name	Cumberland (CUF) Reservation	Johnsonville (JCT) Reservation	Gleason Reservation	Habitat	Potential Habitat Presence		
					CUF	JCT	Gleason
Grassleaf arrowhead *(Sagittaria graminea)*				Littoral areas in ponds and lakes, swamps, or muddy banks			
Hairy Hawkweed *(Hieracium longipilum)*	SSC			Dry fields and sandy road banks	X		
Hairy umbrella-sedge *(Fuirena squarrosa)*		SSC		Mesic communities, including sphagnous bogs, and can be found infrequently in pine-palmetto communities and wet prairies			
Halberd-leaf tearthumb *(Polygonum arifolium)*			ST	Wetlands and marshes			UNK
Harbison's hawthorn *(Crataegus harbisonii)*			SE	Dry rocky calcareous woods			UNK
Harper's fimbristylis *(Fimbristylis perpusilla)*		SE		Muddy shores and exposed bottoms of limesinks, flatwoods, farm ponds, and silty sandbars			
Heller's catfoot *(Pseudognaphalium helleri)*		SSC		Dry sandy woods			
Lake cress *(Neobeckia aquatica)*	SSC			Gum or cypress swamps			
Lamance iris *(Iris brevicaulis)*	SE	SE		Moist fields, damp prairies, wet meadows, moist woodlands, streams, riverbanks, marsh areas, around lakes and ponds, in ravines at the base of wooded slopes	X		
Lance-like spike rush *(Eleocharis lanceolata)*	SSC			Wet areas	X		
Matted spike-rush *(Eleocharis intermedia)*	SE			Wet areas	X		
Naked-stem sunflower *(Helianthus occidentalis)*			SSC	Limestone glades and barrens			
Northern prickly-ash *(Zanthoxylum americanum)*	SSC+			Identified in deciduous bottomland forest wetland on the CUF Reservation during surveys in 2021.	X		

Common and Scientific Name	Cumberland (CUF) Reservation	Johnsonville (JCT) Reservation	Gleason Reservation	Habitat	Potential Habitat Presence		
					CUF	JCT	Gleason
Ozark downy phlox *(Phlox pilosa ssp. Ozarkana)*	SSC			Rocky, dry open woods	X		
Price's potato bean *(Apios priceana)*	FT, SE			Openings in rich woods	X		
Purple milkweed *(Asclepias purpurascens)*	SSC			Barrens			
Red turtlehead *(Chelone obliqua)*			SSC	Alluvial swamps, wet woods			UNK
River bulrush *(Bolboschoenus fluviatilis)*		SSC		Marshes, openings in swamps, edges of ponds and streams, fresh tidal marshes, and inland salt marshes and ponds			
Sand grape *(Vitis rupestris)*				Gravelly banks, river bottoms, stream beds, washes, and scoured boulders and cobbles; along the edges of limestone glades and barrens			
Short-beaked arrowhead *(Sagittaria brevirostra)*	ST	ST		Swamps and floodplains	X		
Short's bladder pod *(Physaria globosa)*				Dry, open limestone ledges on river bluffs, talus of lower bluff slopes, and shale at cliff bases; usually south- to west-facing rocky slopes and the tops, ledges, or bases of steep cliffs along major waterways			
Short's rock-cress *(Boechera shortii)*		SSC		Wooded bluffs and plains			
Smaller mud plantain *(Heteranthera limosa)*		ST		Small ephemeral rainwater pools			
Spinulose shield fern *(Dryopteris carthusiana)*			ST	Bogs			
Spreading false-foxglove *(Aureolaria patula)*	SSC			Oak woods and edges	X		

Common and Scientific Name	Cumberland (CUF) Reservation	Johnsonville (JCT) Reservation	Gleason Reservation	Habitat	Potential Habitat Presence		
					CUF	JCT	Gleason
Swamp lousewort *(Pedicularis lanceolata)*	SSC			Wet acidic barrens and seeps			
Sweet coneflower *(Rudbeckia subtomentosa)*	ST			Barrens			
Sweetscent ladies'-tresses *(Spiranthes odorata)*		SE		Swamps and pond margins			
Sweet-scented indian plantain *(Hasteola suaveolens)*	SSC			Alluvial woods, moist slopes			
Texas goldentop *(Euthamia gymnospermoides)*	SE+			Identified during field surveys on the CUF Reservation in 2021 in early successional habitat within a transmission ROW	X		
Torrey's mountain mint *(Pycnanthemum torreyi)*				Dry upland forests, dry rocky woodlands over mafic, ultramafic, or calcareous rocks, edges of sandstone glades, dry-mesic barrens, thickets, upland meadows, and powerline ROWs			
Walter's barnyard grass *(Echinocloa walteri)*		SSC		Openings in the floodplain woodlands, swamps, marshes, low areas along ponds, rivers, and ditches. This grass also prefers disturbed open fields.			
Water-purslane *(Didipis diandra)*			ST	Swamps			
Insects							
Monarch butterfly *(Danaus plexippus)*	FC	FC	FC	Milkweed and flowering plants	X		X

FE = Federal-Endangered; FT = Federal-Threatened; FPE = Federal Proposed Endangered; FPT = Federal Proposed-Threatened; FC: Federal Candidate for Listing; SE = State-Endangered; ST = State-Threatened; SSC = State Special Concern; SD = State Deemed in Need of Management; SR = State rare and uncommon,
UNK = Potential presence but unknown pending field surveys for suitable habitat conditions
*Protected under the Bald and Golden Eagle Protection Act
+Record of observation on site

3.8.4.1. Affected Environment

3.8.4.1.1. CUF Reservation

Fish, wildlife, and plant species under state or federal protection that may be found on or in the vicinity of the CUF Reservation are summarized in Table 3.8-6. No federally designated critical habitat is located on the CUF Reservation. Species with potential habitat on CUF Reservation and those that have been directly observed on site are discussed below.

3.8.4.1.1.1. Birds

One species of bird (Henslow's sparrow) was listed as state-threatened based on the reviewed resources; five other species (Bewick's wren, bald eagle, cerulean warbler, golden eagle, and Swainson's warbler) were classified by the state as "Deemed in Need of Management." Species Deemed in Need of Management are those that "the director of TWRA believes should be investigated in order to develop information relating to populations, distribution, habitat needs, limiting factors, and other biological and ecological data to determine management measures necessary for their continued ability to sustain themselves successfully." All of the state or federally protected bird species or species of conservation concern have the potential to be present on the CUF Reservation based on required habitat and those habitats described in recent field surveys (TVA 2021h) (Table 3.8-6).

Henslow's sparrow habitat consists of damp open fields and meadows with grass interspersed with weeds or shrubs. On the CUF Reservation, this habitat may be found in or near wetlands contained in the former agricultural fields or in early successional habitat along existing transmission ROWs. Former agricultural fields and transmission ROWs are disturbed areas which commonly support both native and non-native, weedy plant species. The early successional habitat on CUF Reservation was observed to contain mainly annual ragweed, beefsteak plant, brown eyed susan, and late-flowering thoroughwort; the former agricultural fields contained typical invasive plants such as Johnson grass and sericea lespedeza, as well as other native and non-native species (see Section 3.8.1.1.1, Figure 3.8-1); in combination with the wetlands identified in this area (Figure 3.6-1), these characteristics may provide the habitat to support the Henslow's sparrow.

Golden eagle is state Deemed in Need of Management and are also protected under the BGEPA (USFWS 2011). Tennessee is within the non-breeding resident range for this species (Table 3.8-6). The TVA RNHD found no records of a golden eagle within three miles of the CUF Reservation and the site would provide no nesting habitat; however, nearby waterbodies and fields may provide foraging grounds and therefore this species may be observed passing through the area. Bald eagle is also state Deemed in Need of Management, as well as protected under the BGEPA (USFWS 2011). Suitable nesting trees exist for bald eagle along Wells Creek and the Cumberland River. Bald eagles are typically found near large, open bodies of water such as rivers, lakes, and reservoirs. Bald eagles will nest on cliffs or large trees near water (NatureServe 2021). A search of the TVA natural heritage database shows 24 records of bald eagles within Stewart County. A bald eagle nest was active from 2005-2009 near CUF, approximately 0.26 mile west of CUF between the two TVA transmission line ROWs, suggesting habitat in this area is suitable for bald eagle nesting. No bald eagles or nests were observed during the 2021 field surveys despite significant efforts to locate old nests at previous nesting locations. However, anecdotal reports state that they have been sighted flying over and near the project area foraging over the Cumberland River.

Suitable nesting habitat also exists for osprey on the CUF Reservation (Figure 3.8-2). Osprey have a subnational conservation status rank of "Vulnerable" in Tennessee, meaning they have

been deemed by NatureServe to have a “moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors” (NatureServe 2021). Nests are made of branches, sticks, twigs, and lined with smaller material. Six of the osprey nests are on lights over mooring cells in the Cumberland River, four nests are on lighting towers or structures around the coal pile, and the remaining six nests are on transmission structures in and around the plant site.

Bewick’s wren is also state Deemed in Need of Management (Table 3.8-6). This species prefers brushy areas, thickets, and scrub areas in open country. Similar to Henslow’s sparrow, this habitat type may be found in disturbed areas such as existing transmission ROWs or former agricultural fields on site (see Section 3.8.1.1.1, Figure 3.8-1). No Bewick’s wrens were observed during the 2021 wildlife and protected terrestrial animal species assessment (TVA 2021h).

Cerulean warbler and Swainson’s warbler are both species Deemed in Need of Management that require habitat exhibiting mature floodplain or mesic deciduous forests (Table 3.8-6). About 10 percent of the deciduous forests on site consists of mesic or bottomland forest type (approximately 112 acres). Therefore, these species may be present if habitat is sufficient. No cerulean or Swainson’s warblers were observed during the 2021 wildlife and protected terrestrial animal species assessment (TVA 2021h).

Migratory Bird Species

Approximately 291 species of migratory birds have been identified in Stewart County, Tennessee (eBird 2021), and additional species likely occur regularly. The USFWS maintains a list of migratory birds of conservation concern (USFWS 2021a). These species are not listed under the ESA but are a high conservation priority of the USFWS and without additional conservation action are likely to become candidates for listing under the ESA. Twenty-three species of birds of conservation concern are listed for Bird Conservation Region 24, Central Hardwoods, which contains the CUF Reservation (USFWS 2021a). Species from this list with a “common” occurrence (during all seasons, breeding, wintering, or migration) as shown on range maps by the National Audubon Society (2022) were listed in Table 3.8-7. Additionally, species from the Migratory Birds list obtained from the USFWS IPaC report and the results of the 2021 wildlife and protected terrestrial animal species assessment were also included.

Table 3.8-7. Migratory Bird Species of Conservation Concern Potentially Occurring in or identified on the CUF Reservation.

Common Name	Scientific Name	General Habitat Description	Habitat Present on Project Site
Migrant Species (present as spring and fall migrant and/or during winter)			
Lesser yellowlegs	*Tringa flavipes*	Winters and migrates along mudflats, sandy beaches, shores of lakes and ponds, and wet meadows.	No
Bobolink	*Dolichonyx oryzivorus*	Grasslands, meadows, and hayfields.	Yes
Rusty blackbird	*Euphagus carolinus*	Winters in swamps, wet woodlands, and pond edges.	Yes, limited
Semipalmated sandpiper	*Calidrus pusilla*	Winters and migrates along mudflats, sandy beaches; wet shores of lakes, ponds, meadows	No

Common Name	Scientific Name	General Habitat Description	Habitat Present on Project Site
Breeding Season Migrants (may occur only during the breeding season)			
Bewick's wren (eastern)	*Thryomanes bewickii bewickii*	Overgrown fields, fencerows, woodland edges, often around buildings.	Yes
Chimney swift	*Chaetura pelagica*	Forages over variety of habitats, requires chimneys or large hollow tree snags with open tops for nesting	No
Eastern Whip-poor-will	*Antrostomus vociferus*	Woodlands with open understory.	Yes
Grasshopper sparrow	*Ammodramus savannarum*	Grasslands, meadows, and hayfields.	Yes
Kentucky warbler	*Geothlypis formosa*	Large moist forest tracts with mature trees and thick understory.	Yes*
Prothonotary warbler	*Protonotaria citrea*	Breed in flooded bottomland forests, wooded swamps, and forests near lakes and streams larger than 250 acres.	Yes
Prairie warbler	*Dendroica discolor*	Various shrubby habitats, including regenerating forests, open brushy fields, and Christmas tree farms	Yes*
Wood thrush	*Hylocichla mustelina*	Breeds in mature deciduous and mixed forests, forests with dense understory, and forest edges.	Yes*
Resident Species (may occur year-round)			
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Deciduous woodlands with oak or beech, groves of dead or dying trees, forested river bottoms, recent clearings, farmland, grasslands, forest edges and roadsides	Yes*
Field sparrow	*Spizella pusilla*	Old fields and brushy areas.	Yes
Bald eagle	*Haliaeetus leucocephalis*	Nest in forested areas adjacent to large bodies of water. For perching they prefer tall coniferous or deciduous trees.	Yes*
Blue-winged Warbler	*Vermivora cyanoptera*	Nest in shrubby, second-growth habitat with scattered trees, such as abandoned farmland and forest clearings	Yes*

*Migratory birds of conservation concern potentially found on the CUF Reservation as determined by the 2021 wildlife and protected terrestrial animal species assessment (TVA 2021h).
+Known nesting or colony locations on CUF Reservation

Many of the species listed in Table 3.8-7 have suitable habitat on the CUF Reservation, particularly those using deciduous forests or fields which were the dominate vegetation communities on the CUF Reservation (Section 3.8.1.1.1). Several species comprising bald eagle, blue-winged warbler, Kentucky warbler, prairie warbler, red-headed woodpecker, and wood thrush were identified during a query of USFWS' IPaC query for the CUF Reservation,

and all of these were documented on site during the July 2021 site visit or based on previous nesting records.

Bald eagle, as discussed above, is a species Deemed in Need of Management by the TWRA and is also protected under the MBTA and BGEPA. Although no nests were observed during the 2021 surveys, the documented history of nesting on site indicates this area contains suitable habitat consisting of large, mature trees for nest building and nearby open water for foraging (i.e., Cumberland River).

Three notable species of migratory bird have been confirmed with nesting locations and/or colonies on the CUF Reservation. Sixteen osprey nests, one double-crested cormorant (*Phalacrocorax auratus*) colony, and one cliff swallow (*Petrochelidon pyrrhonota*) colony were observed during the field surveys in July 2021 (TVA 2021h) (Figure 3.8-2). As stated above, osprey nests have been observed on lights over mooring cells in the Cumberland River, on lighting towers, and on transmission line structures. The cormorant nests are also on a transmission structure in the middle of Wells Creek.

A colony of cliff swallows with approximately 100 nests and 200 pairs of birds was originally observed nesting under a busy bridge over Wells Creek by TVA terrestrial zoologists in May 2017; although evidence indicates the colony had likely been established there for several years prior. The colony was again active at the time of the July 2021 field survey (TVA 2021h) (Figure 3.8-2). The colony has exhibited a tolerance for disturbance as they continue to roost under a busy road often traveled by large trucks. TVA has taken measures to protect this nesting colony during previous proposed actions by putting seasonal avoidance commitments on nearby activities.

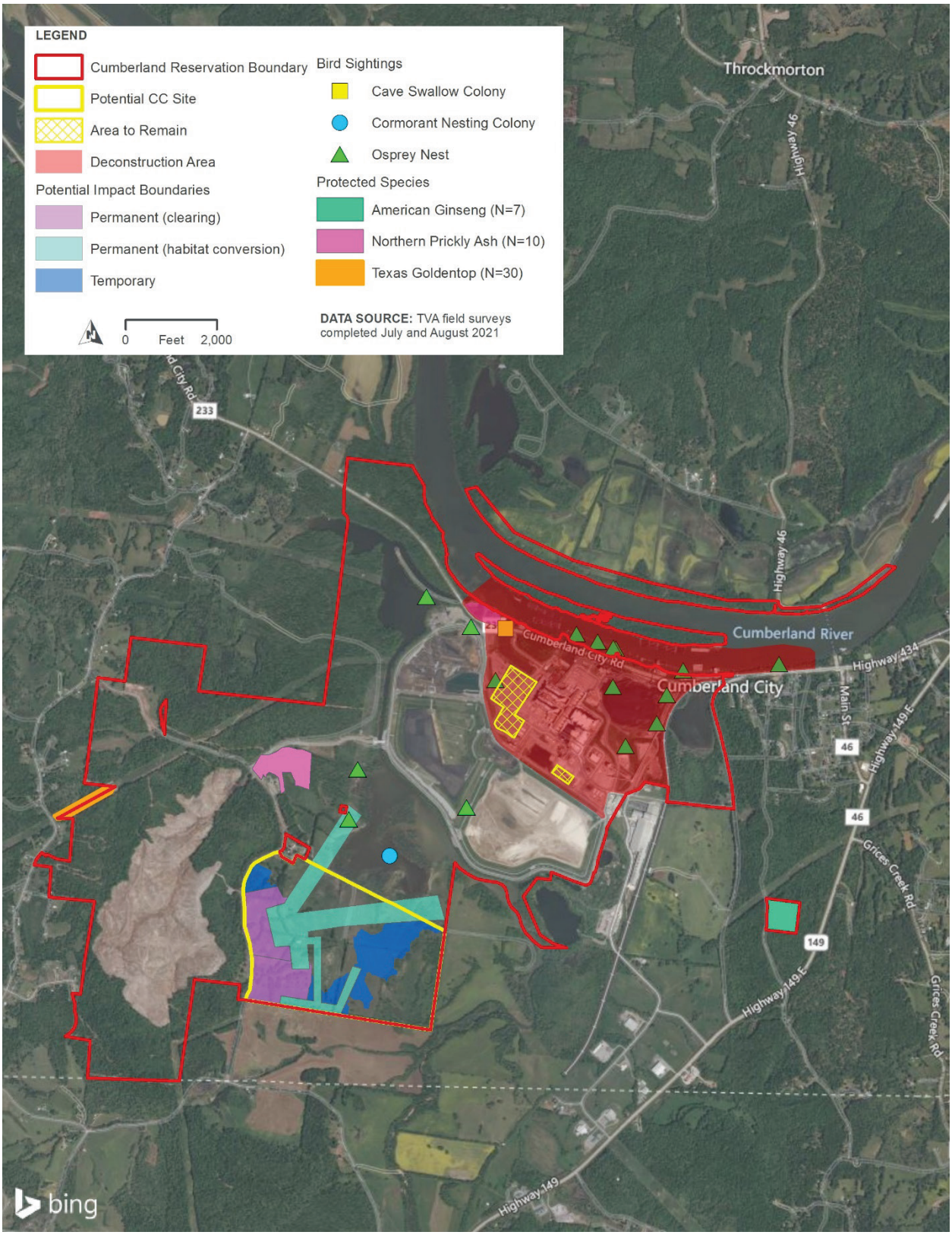

Figure 3.8-2. Protected Species Observations on the Cumberland Reservation

3.8.4.1.1.2. Mammals

Three species of bat with protected status were identified on the resources lists, comprising gray bat, Indiana bat, and northern long-eared bat (Table 3.8-6). The tricolored bat, a proposed endangered species by the USFWS and a state-threatened species, has also been captured during mist net surveys on CUF Reservation in 2011 (TVA 2021h) and therefore is also included in this review.

Gray bats almost exclusively roost in large caves throughout the year. They are sometimes found roosting in mines or buildings (NatureServe 2021). The TVA database has 12 records of gray bats in Stewart County. The closest record of this species is from a cave 7 miles away from CUF. No gray bats were captured during mist netting surveys in 2011 (ESI 2011). No suitable natural roosting habitat for gray bat is present on CUF Reservation. Foraging habitat for this species may occur over open water areas associated with Wells Creek and the Cumberland River. Lower quality foraging habitat may be found over ash impoundments.

Indiana bats overwinter in large numbers in caves and forms small colonies under loose bark of trees and snags in summer months (Barbour and Davis 1974). During the summer it favors mature forests interspersed with openings and roots in trees with snags, cavities or exfoliating bark. Use of living trees, especially species such as shagbark hickory, mature white oaks, and other trees with suitable roost characteristics near suitable snags, has also been documented. Multiple roost sites are generally selected. The availability of trees of a size and sun exposure are other important limiting factors contributing to roost site suitability (Tuttle and Kennedy 2002, Harvey and Britzke 2002, Kurta et al. 2002). A search of the TVA database indicates five records of Indiana bat within Stewart County. The forested areas and open areas over Wells Creek, the Cumberland River and the ash impoundments may provide suitable foraging habitat for this species. Additionally, CUF is within known swarming area for Indiana bats (USFWS 2015). No Indiana bats were captured during mist netting surveys in 2011 (ESI 2011). No active summer roost sites were identified. No natural winter hibernacula occur on CUF Reservation; however, most forested areas provide some value as potential summer roosting habitat for Indiana bat. Potential habitat depicted on Figure 3.8-3 includes areas with both roosting and foraging opportunities.

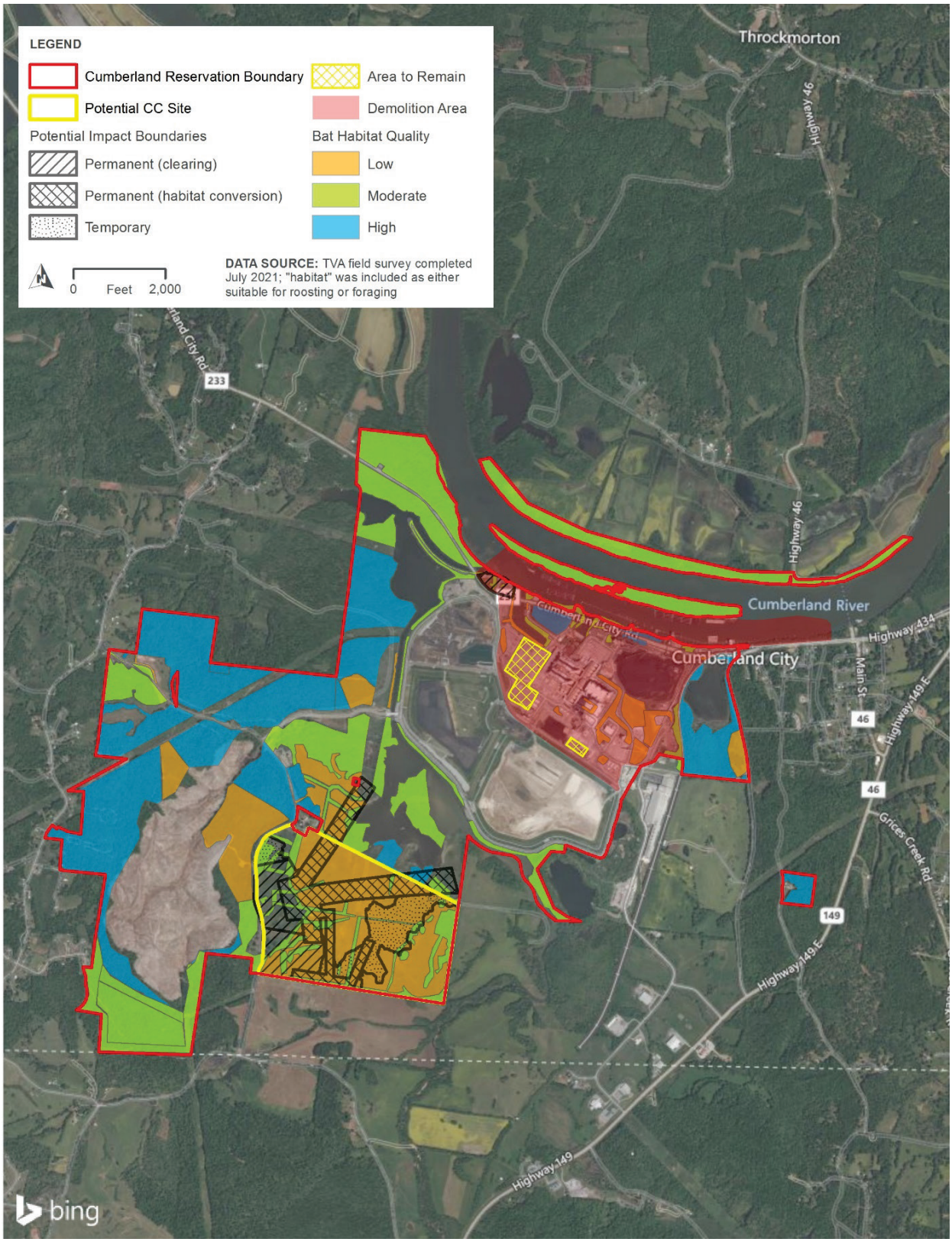

Figure 3.8-3 Potential Bat Habitat on the Cumberland Reservation

Northern long-eared bats suitable hibernacula include caves and cave-like structures such as mines and railroad tunnels. These hibernacula typically have large passages with cracks and crevices for roosting; relatively constant, cool temperatures (32 to 48°F) and high humidity and minimal air currents. During summer, this species roosts singly or in colonies in cavities, underneath bark, crevices, or hollows of both live and dead trees (typical diameter greater than or equal to 3 inches). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats forage in upland and lowland woodlots, treelined corridors, and water surfaces, feeding on insects. In general, habitat use by northern long-eared bats is thought to be similar to that used by Indiana bats, although northern long-eared bats appear to be more opportunistic in selection of summer habitat (USFWS 2016). Like Indiana bat, most forested areas provide some value as potential summer roosting habitat for northern long-eared bat. Also similar to Indiana bats, the forested areas and open areas over Wells Creek, the Cumberland River and the ash impoundments may provide suitable foraging habitat for this species (Figure 3.8-3). A search of the TVA Natural Heritage Database indicates two records of northern long-eared bats captured within Stewart County. No natural winter roosting habitat was identified during on CUF during 2021 field surveys. However, one hibernaculum is known within 5-miles of the CUF Reservation. In addition, one northern long-eared bat was captured during 2011 ESI surveys approximately 0.83 miles from the CUF plant property

The tricolored bat used to be a common bat species in Tennessee that once was found state-wide. Due to significant declines in winter colony abundance due to the white-nose syndrome, this species is currently proposed for listing as endangered under the ESA. Tricolored bats are generally solitary or found in small groups. They are associated with forested landscapes where they forage along forest edges and along waterways. Summer roosts are primarily in live and dead leaf clusters of live or recently dead deciduous hardwood trees. However, this species has also been documented roosting in pines, cedars, and artificial structures such as barns, brides, bunkers, and residential roofs during summer months. In winter, this species is most commonly found in caves and mines but may also use culverts, abandoned wells, and tree cavities and rock shelters (USFWS 2021b). No natural suitable habitat exists on CUF Reservation for winter hibernation, however forested areas of the site provide summer roosting habitat. In addition, three tricolored bats were captured during 2011 ESI surveys. One of these was a male captured approximately 0.83 miles from the CUF property. Another was a lactating female captured on Old Scott Road within the CUF Reservation. And the third was a male captured in forest off the west side of the landfill on the CUF Reservation. This suggests that there were maternity roosting sites of tricolored bat in the area over a decade ago. The locations of the capture of these state-listed species are omitted from Figure 3.8-2.

No evidence of roosting bats was observed on or under the bridge closest to the proposed demolition. Buildings proposed for demolition may offer suitable roosting habitat if left abandoned for several years; however, none have roosting bats at this time. Forested habitat on the CUF ranged from low to high quality as suitable summer roosting habitat for federally listed Indiana bat and northern long-eared bat following Phase 1 Bat Habitat Assessments. Across the CUF site 325.9 acres of forest was identified as low quality habitat (meaning foraging habitat only), 487.5 of moderate quality roosting habitat, and 550.7 acres of high quality roosting habitat (Figure 3.8-3)

3.8.4.1.1.3. Reptiles

Three reptiles are state-listed as threatened: alligator snapping turtle, northern pinesnake, and western pygmy rattlesnake (Table 3.8-6). The alligator snapping turtle is also proposed for federal listing as threatened. It is a rare reptile that is restricted to drainages, floodplains, swamps, and oxbow lakes associated with large rivers, only emerging from water for nesting

and basking. The species does not inhabit isolated wetlands and ponds. Nesting occurs on riverbanks and sandbars along the waters' edge (NatureServe 2021). There is potential for foraging habitat for the alligator snapping turtle to be present in the Cumberland River within the demolition boundary; however, no nesting habitat is likely to fall within this disturbance area. Potentially suitable foraging and nesting habitat in and around Wells Creek also exists.

Northern pinesnake is a large, nonvenomous snake typically found in sandy, well-drained upland pine or pine-oak woodlands. Northern pine snakes spend the majority of their time underground, but they are often encountered aboveground during spring and late summer to early autumn (Tennant 2003; Tuberville and Mason 2008). No habitat exists on-site to support the northern pinesnake.

Western pygmy rattlesnake is a small venomous snake that may utilize a variety of habitats from wetland areas to pine-hardwood forests. This animal is extremely secretive and seldom encountered as it spends the day hidden beneath groundcover (Tennant 2003). Births usually occur in summer (NatureServe 2021). Based on field surveys of vegetation communities and surface water resources completed in 2021, there may be suitable habitat within the CUF Reservation for this species.

3.8.4.1.1.4. Amphibians

Eastern hellbender is a large salamander state-listed as endangered in Tennessee. (Table 3.8-6) It is found in clear, rocky creeks and rivers with water temperatures that are ideally less than or equal to 20°C, and where there are large shelter rocks. Eggs are laid in nests in late summer or fall beneath these large, flat shelter rocks or submerged logs (Petranka 1998). No habitat exists on the CUF Reservation to support the hellbender.

3.8.4.1.1.5. Plants

Eleven threatened or endangered plant species were identified on the various state and federal protected species lists for CUF Reservation (Table 3.8-6). An additional 14 species are listed as State Special Concern. Of these species, three were identified during the 2021 field surveys: American ginseng, northern prickly-ash, and Texas goldentop.

American ginseng is a state-listed Species of Special Concern and is listed due to commercial exploitation. Seven American ginseng plants were identified during field surveys in September 2021 outside of the area that would be impacted by the demolition and CC construction (Figure 3.8-2).

Northern prickly-ash is state-listed Species of Special Concern and was identified on CUF Reservation during 2021 field surveys. Ten northern prickly-ash trees were identified in a 17.3-acre disturbed, deciduous bottomland forest on the central-west portion of the CUF Reservation (Figure 3.8-2). This habitat had overstory species such as American basswood, American sycamore, black walnut, Osage orange, slippery elm, and southern hackberry, sugar maple, and sweetgum, with bear's foot, common greenbrier, Chinese privet, coralberry, ironwood, multiflora rose, northern spicebush, pawpaw, river cane, winged elm, and overstory saplings in the understory. Herbaceous plants in this area included Broadleaf arrowhead, Canadian honewort, cardinal flower, Carolina elephant's-foot, Christmas fern, fox sedge, Frank's sedge, Japanese stiltgrass, jumpseed, smallspike false nettle, sweet woodreed, Virginia spiderwort, and wingstem.

Texas goldentop is a state-listed endangered species identified on the CUF Reservation during 2021 field surveys. Thirty Texas goldentop were observed in a 5.5-acre transmission ROW on

the west portion of CUF Reservation (Figure 3.8-2) consisting mainly of annual ragweed, beaked panic grass, blackeyed Susan, clustered mountain mint, flat-top goldenrod, golden tickseed, gray goldenrod, greater tickseed, hairy sunflower, hyssopleaf thoroughwort, little bluestem, Maryland meadow beauty, pink fuzzy bean, poorjoe, purple passionflower, roundleaf thoroughwort, wild bergamot, wholeleaf rosinweed, and wrinkleleaf goldenrod.

3.8.4.1.1.6. Aquatic Species

Four aquatic animal species including two fish and two mussels are listed in Table 3.8-6 for CUF Reservation based on the reviewed resources, including blue sucker, lake sturgeon, pink mucket, and rabbitsfoot.

Blue sucker is state-listed as threatened in Tennessee. It is a bottom-feeding fish that can be found in large rivers and lower parts of major tributaries in channels and flowing pools with moderate current. Occasionally they can be found in impoundments. Adults migrate upstream to spawn in riffles (NatureServe 2021). One blue sucker was captured upstream and five blue suckers were captured down stream of CUF during gill netting sampling as a part of 2015 biological monitoring of the Cumberland River (TVA 2016a). Most recently, two blue suckers were collected during electrofishing surveys in fall 2019 (TVA 2020b).

Lake sturgeon is a state-listed endangered fish in Tennessee. It is a target species for a state-sponsored reintroduction program and has been aggressively stocked in many Tennessee reservoirs since 2000. Lake Sturgeon are supra-benthic cruisers who are constantly on the move in search of food including midges, leeches, snails, small clams, crustaceans, and sometimes small fish. Adults require large areas of rivers and lakes less than 30 feet deep with clean, fresh water (NatureServe 2021). Lake sturgeon are found in the vicinity of CUF and were captured each year from 2009 to 2016 during biological surveys (TVA 2020b). One individual lake sturgeon was also collected during impingement sampling at CUF during the 2005-2007 impingement study (TVA 2007).

The pink mucket mussel is state- and federally listed as endangered, and the rabbitsfoot mussel is state- and federally listed as threatened. Both species are found in large rivers with sand and gravel substrates. A mussel survey in 2011 in the thermally affected area of the Cumberland River near CUF yielded no state- or federally protected mussel species; river substrates were categorized as degraded/sub-optimal in the study area with clay as the dominant substrate overlain by silt (TVA 2020b). Although a recent mussel survey was not performed, it is unlikely that the barge area provides suitable habitat for sensitive mussel species; this portion of the Cumberland River is widely regarded as being poor habitat for federally listed mussels, mostly due to the serial impoundment of the Cumberland River, ongoing operation of Cumberland Fossil Plant, and decades of continuous barge traffic. In recent consultation with the U.S. Fish and Wildlife Service, TVA made a No-Effect determination on federally listed mussels based on these factors and the USFWS acknowledged this determination with no comments in a letter dated July 20, 2022.

3.8.4.1.1.7. Insects

Monarch butterflies are currently classified as a federal candidate species for listing. They are milkweed specialists and prefer habitats that provide them this species and other flowering plants, such as roadside areas, open areas, wet areas, or urban gardens (NatureServe 2021). While the former agricultural fields and existing transmission lines on the CUF Reservation may provide habitat for milkweed and/or the monarch butterfly, milkweed was not noted as a dominant plant during 2021 field surveys in the disturbed (former agricultural) fields or transmission ROW (early successional) areas or anywhere else on CUF Reservation.

3.8.4.1.2. Alternative A

3.8.4.1.2.1. Proposed CC Plant Site

The proposed CC plant site and associated transmission line area is located within the boundary of the CUF Reservation; therefore, the species listed in Table 3.8-6 for CUF Reservation may be found on the CC plant site or within the TL corridor. However, based on the habitat types identified in the vegetation community described for the CC plant site during 2021 field surveys species that could have potential habitat on the CC plant site include: Alligator snapping turtle, Bewick's wren, cerulean warbler, Henslow's sparrow, Swainson's warbler; foraging habitat for gray bat; foraging and roosting habitat for tricolored bat, Indiana bat, northern long-eared bat; western pygmy rattlesnake; and monarch butterfly. No bald eagles or their nests were observed during 2021 field surveys (TVA 2021h). The plant species marked as potentially occurring on site in Table 3.8-5 are generally found in habitats that could be present on the CC plant site or along the transmission line corridor, however no protected plant species were identified in these areas during targeted protected species surveys in September 2021 or during stream and wetland surveys in July/August 2021. Therefore, it is unlikely that these protected species are present. As stated above, no federally designated critical habitat is located on the CUF Reservation and therefore there is no designated critical habitat on the proposed CC plant site.

The majority of the CC plant site and transmission areas consists entirely of low-quality bat habitat (74 percent, or 113.5 acres) and medium-quality bat habitat (24.5 percent or 37.5 acres This area is primarily disturbed field interspersed with tree lines which may provide summer roosting habitat for all of the protected bat species except gray bats.

The migratory bird species of conservation concern for the proposed CC plant site are the same as those listed and discussed for the CUF Reservation in Section 3.8.4.1.1.1. None of the species' nests or colonies as shown on Figure 3.8-2 are located within the proposed CC plant boundary; however, five osprey nests and a cormorant nesting colony fall within the proposed transmission line area. There is also potential for nests to be present along the OPGW transmission line. The osprey and cormorant nests are all located on existing transmission structures.

3.8.4.1.2.2. Natural Gas Pipeline Corridor

The pipeline corridor crosses several counties with a variety of vegetation communities (see Section 3.8.1.1.1.2) and aquatic features (see Sections 3.8.3.1.2.2). Many areas crossed by the corridor have potential to provide quality habitat for wildlife, including some protected or rare species primarily associated with forested or field habitat, and/or streams and wetlands as listed in Table 3.8-6.

According to TGP Resource Report 3 (TGP 2022c):

> …the following activities were conducted to determine the federal and state listed species of interest that could occur within the [natural gas pipeline corridor]:
>
> - A review was completed of recent aerial imagery and USGS 7.5-minute Quadrangle maps.
> - An inquiry was sent to the USFWS IPaC system to determine what federal species under the ESA, BGEPA, and/or MBTA could occur within or near [pipeline] study area.

- The TDEC Division of Natural Areas Natural Heritage Portal – Rare Species by County and HUC-12 Code Watersheds was consulted to determine the state species of interest that could occur within or near the [pipeline] (TDEC 2021c).
- An inquiry was sent to the TDEC Division of Natural Areas Natural Heritage Program to identify any records of federal or state species within the [pipeline]. The TDEC Division of Natural Areas Natural Heritage Program provided a response on June 29, 2021.
- Species habitat surveys were conducted from June through August of 2021.
- A bat mist net survey was conducted in June and August 2021.
- TGP conducted mussel surveys in September 2021 in accordance with USFWS-approved protocols.
- Plant species presence-absence surveys in the pipeline area were conducted from June 21-30, 2021; August 4-5, 2021; August 16-19, 2021; and September 8-9, 2021, in accordance with agency-approved survey protocols and during the flowering window for the federally and state-listed plant species with potential to occur in the [pipeline] area.
- A response was received from USFWS, dated March 10, 2022, acknowledging TGP's findings and proposed mitigation measures related to wildlife and their habitats (TGP 2022a, Appendix 1.F).

Federally and state-listed species identified on the resource lists are summarized in Table 3.8-8 below.

Table 3.8-8. Federally and State-Listed Species Potentially Occurring along the Pipeline[1]

Common Name	Scientific Name	Status	Preferred Habitat	Potential Habitat Observed (Y/N)
Birds				
Golden eagle[2]	*Aquila chrysaetos*	BGEPA	Larger mature trees usually found near larger waterways	N
Bald eagle[3]	*Haliaeetus leucocephalus*	BGEPA	Larger mature trees usually found near larger waterways	N
Flowering Plants				
Price's potato-bean[4]	*Apios priceana*	FT	Sightly disturbed areas such as forest openings, wood edges, and where bluffs descend to streams	Y
Butternut[4]	*Juglans cinerea*	ST	Stream benches and areas with good drainage	Y
Short's bladderpod[4]	*Physaria globosa*	FE	Cedar glades and rocky areas	Y
Grassleaf arrowhead[4]	*Sagittaria graminea*	ST	Ponds and stream margins	Y
Sand grape[4]	*Vitis rupestris*	SE	Sandy, rocky riverbanks	Y

Common Name	Scientific Name	Status	Preferred Habitat	Potential Habitat Observed (Y/N)
Broadleaf bunchflower[4]	*Melanthium latifolium*	SE	Rocky forest slopes	Y
Fishes				
Lake Sturgeon	*Acipenser fulvescens*	SE	Bottoms of large, clean rivers and lakes	Y
Blue Sucker	*Cycleptus elongatus*	ST	Swift waters over firm substrates in big rivers	Y
Freshwater Mussels				
Rabbitsfoot[5]	*Quadrula cylindrica cylindrica*	FT	Small to medium sized streams and large rivers with clear shallow water	Y
Tan riffleshell[5]	*Epioblasma florentina walkeri (=E. walkeri)*	FE	Small to medium sized streams and large rivers with cobble or gravel shoals	Y
Mammals				
Gray bat[6]	*Myotis grisescens*	FE	Caves in limestone karst areas, forages in streams, ponds, and wetlands	Y
Indiana bat[6]	*Myotis sodalis*	FE	Woodland edges and forest openings where trees are warmed by the sun, forages in in forested stream corridors, upland and bottomland forests, forested wetlands, and along wooded edges of agricultural fields, pastures, and impounded bodies of water	Y
Northern long-eared bat[6]	*Myotis septentrionalis*	FT	Winter in caves, abandoned mines, and cave-like structures, summer beneath exfoliating bark or in crevices of both live and dead trees, forages below the canopy of mature forests on hillsides and roads, and occasionally over forest clearings and along riparian areas	Y
Reptiles				
Northern pinesnake[7]	*Pituophis melanoleucus*	ST	Well-drained, sandy soils, especially in pine or mixed pine-hardwood forests	N

[1]TGP 2022c,[2]TWRA 2007, [3]TWRA n.d., [4]TDEC 2021c, [5]Clayton et al. 2015, [6]USFWS. 2022b, [7]Zappalorti and Torocco.

Based on field surveys, six species of protected plants, two fish, two mussels, and three bat may have suitable habitat along the natural gas pipeline. No protected plant species were identified during surveys conducted during the appropriate survey windows; therefore these species are unlikely to be present in the natural gas pipeline corridor. In consultation with the USFWS and TWRA, TGP determined that “no vegetation communities of special concern are crossed or impacted by the [pipeline]” (TGP 2022c).

Four aquatic species were identified on the protected species lists. The two fish species, lake sturgeon and blue sucker, require large rivers or lake habitat. The natural gas pipeline would not cross any features large enough to provide suitable habitat for these species except possibly Wells Creek, however this creek is likely too small and either species are not likely to remain for long periods if ventured into the area from the Cumberland River. Overall, these species are unlikely to be present within the natural gas pipeline corridor.

Two mussel species, rabbitsfoot and tan riffleshell, were identified on the IPaC report. Eight creeks along the corridor which had historic records of mussel presence were surveyed on September 8-9, 2021. No protected mussel species were observed during the surveys, and furthermore, “the substrate in all the stream survey reaches was observed to be either shifting gravel/sand or bedrock. These substrate types do not provide suitable mussel habitat” (TGP 2022c, Appendix 3.B).

Three protected bat species were identified on the NHD and IPaC lists: gray bat, Indiana bat, and northern long-eared bat. Mist net surveys were performed between June 21 and August 13, 2021 within the pipeline corridor (TGP 2022c, Appendix 3.A). A total of 129 bats comprising 5 species were captured during the survey efforts, including 9 endangered gray bats and 3 proposed-endangered tricolored bats. No Indiana bat or northern long-eared bat were captured. “Unlike many of the species of bats that inhabit Tennessee, the gray bat uses caves throughout the year. Review of the TVA RNHD (accessed July 2021) and enquiries with landowners did not identify any known caves within 0.5-mile of the [pipeline], nor were caves identified during field surveys” (TGP 2022c, Appendix 3.A). Therefore, it is unlikely that the gray bat is present within the natural gas pipeline corridor except during foraging.

As stated previously, the tricolored bat is associated with forested landscapes where they forage along forest edges and along waterways. Summer roosts are primarily in live and dead leaf clusters of live or recently dead deciduous hardwood trees. Habitat for the tricolored bat may exist in presently forested areas along the natural gas pipeline corridor.

No bald eagles or golden eagles or their nests were identified during the field surveys. Bald and golden eagles are not likely to be present in the pipeline corridor except in the vicinity of the Cumberland River and Wells Creek (as indicated in Section 3.8.4.1.1.1) because their habitat requirements include close proximity to large waterbodies for foraging with nearby tall trees for nesting. “In the event a bald eagle or golden eagle nest is subsequently identified prior to or during [pipeline] construction, TGP will comply with the 2007 National Bald Eagle Management Guidelines (USFWS 2007)” (TGP 2022c).

The Fish and Wildlife Coordination Act, as amended in 1988, requires the USFWS to identify Birds of Conservation Concern (“BCC”), which include species, subspecies, and populations of all migratory nongame birds that could become candidates for listing under the ESA if additional conservation actions are not taken. BCCs identified in Table 3.8-8 have the potential to occur in the vicinity of the natural gas pipeline corridor.

The TGP Resource Report 3 (TGP 2022c) provides additional details for federal and state-listed species potentially occurring within the natural gas pipeline corridor, including mileposts of the pipeline where potential habitat was observed during field surveys.

3.8.4.1.3. Alternative B

3.8.4.1.3.1. Johnsonville Reservation

Fish, wildlife, and plant species under state or federal protection that may be found on or in the vicinity of the Johnsonville Reservation according to reviewed species lists are summarized in Table 3.8-5. No federally designated critical habitat is located on the Johnsonville Reservation. Land use on the Johnsonville CT plant site was classified almost entirely as medium- or high-intensity developed space (Figure 3.10-5). The most heavily disturbed and most degraded habitats are currently covered with herbaceous vegetation, including Johnson grass, sericea lespedeza, and other common native and non-native herbaceous species. Most herbaceous vegetation on the Johnsonville Reservation site is dominated by non-native plant species.

Species with potential habitat on Johnsonville Reservation and/or those with direct observational records are discussed below.

3.8.4.1.3.2. Birds

Two protected bird species have records of occurrence near the Johnsonville Reservation: piping plover and little blue heron. Piping plovers forage in exposed sand flats, mudflats, sandy beaches, stream shorelines, and ephemeral ponds. The populations of piping plover that can be found in the Tennessee Valley Region are rare fall and spring migrants. This species has been documented foraging on mudflats in the Kentucky Reservoir 0.4 miles from the Johnsonville Reservation. Piping plover have been documented foraging in settling ponds/ash ponds at other TVA coal plants.

Little blue herons congregate to roost in trees and shrubs near water. They forage for small fish and other aquatic animals in wetlands and lakes. A nesting colony of little blue heron is located approximately 1.7 miles from the Johnsonville Reservation on an island in Kentucky Reservoir. This species has the potential to nest in vegetation around the peninsula and forage in settling ponds/ash ponds.

Migratory Bird Species

The JCT Reservation falls within Bird Conservation Region 24, Central Hardwoods. This region has 23 species of migratory birds of conservation concern that may be found in the area. Species from this list with a “common” occurrence (during all seasons, breeding, wintering, or migration) as shown on range maps by the National Audubon Society (2022) were listed in Table 3.8-9. Species with direct observations are also included.

Table 3.8-9. Migratory Bird Species of Conservation Concern and Other Bird Species Potentially Occurring on the JCT Reservation.

Common Name	Scientific Name	General Habitat Description	Habitat Present
Migrant Species (present as spring and fall migrant and/or during winter)			
Lesser Yellowlegs	*Tringa flavipes*	Winters and migrates along mudflats, sandy beaches, shores of lakes and ponds, and wet meadows.	No
Bobolink	*Dolichonyx oryzivorus*	Grasslands, meadows, and hayfields.	No
Piping Plover	*Charadrius melodus*	Forage in exposed sand flats, mudflats, sandy beaches, stream shorelines, and ephemeral ponds. Rare fall and spring migrants in the TN Valley region.	No*
Rusty Blackbird	*Euphagus carolinus*	Winters in swamps, wet woodlands, and pond edges.	No
Semipalmated Sandpiper	*Calidrus pusilla*	Winters and migrates along mudflats, sandy beaches, shores of lakes and ponds, and wet meadows.	No
Breeding Season Migrants (may occur only during the breeding season)			
Bewick’s Wren (Eastern)	*Thryomanes bewickii bewickii*	Overgrown fields, fencerows, woodland edges, often around buildings.	No

Common Name	Scientific Name	General Habitat Description	Habitat Present
Chimney Swift	*Chaetura pelagica*	Forages over variety of habitats, requires chimneys or large hollow tree snags with open tops for nesting	No
Cliff Swallow	*Petrochelidon pyrrhonota*	Nest on cliff faces and man-made buildings near water bodies, bridges.	No
Eastern Whip-poor-will	*Antrostomus vociferus*	Woodlands with open understory.	No
Grasshopper Sparrow	*Ammodramus savannarum*	Grasslands, meadows, and hayfields.	No
Kentucky Warbler	*Geothlypis formosa*	Large moist forest tracts with mature trees and thick understory.	No
Little Blue Heron	*Egretta caerulea*	Roost in trees and shrubs near water; forage for insects in wetlands and lakes.	No*
Prairie Warbler	*Dendroica discolor*	Various shrubby habitats, including regenerating forests, open brushy fields, and Christmas tree farms.	No
Wood Thrush	*Hylocichla mustelina*	Breeds in mature deciduous and mixed forests, forests with dense understory, and forest edges.	No
Resident Species (may occur year-round)			
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Deciduous woodlands with oak or beech, groves of dead or dying trees, forested river bottoms, recent clearings, farmland, grasslands, forest edges and roadsides	No
Field Sparrow	*Spizella pusilla*	Old fields and brushy areas.	No
Bald Eagle	*Haliaeetus leucocephalis*	Nest in forested areas adjacent to large bodies of water. For perching they prefer tall coniferous or deciduous trees.	No
Blue-winged Warbler	*Vermivora cyanoptera*	Nest in shrubby, second-growth habitat with scattered trees, such as abandoned farmland and forest clearings	No
Double-crested Cormorant	*Phalacrocorax auritus*	Open water, reservoirs, larger lakes, and wide stretches of rivers across Tennessee; Nest on islands on some of the larger lakes in Tennessee	No
Osprey	*Pandion haliaetus*	Found on almost any expanse of shallow, fish-filled water, including rivers, lakes, reservoirs, lagoons, swamps, and marshes.	Yes, confirmed presence
Red-tailed Hawk	*Buteo jamaicensis*	Open country, woodlands, prairie groves, mountains, plains, roadsides. Found in any kind of terrain that provides both some open ground for hunting and some high perches.	Yes, confirmed presence

*Species not identified on JCT Reservation but recent records nearby.

Two notable migratory bird species have been identified on JCT Reservation. Nine osprey nests exist on JCT as of April 2021. Three of these nests were on nesting platforms built specifically for this species, and three nests were observed on mooring cells. One was on a lighting structure north of the coal pile. Several of these nests and/or nest buffers fall within the JCT Reservation boundary.

Red-tailed hawks usually build nests in large trees in an open area or above the canopy near open fields or woodlands. On occasion they will also build nests on man-made structures like transmission towers. One active red-tailed hawk nest was observed at the edge of a switchyard at the southern end of the JCT Reservation in July 2019.

Mammals
Four protected mammal species of state or federal concern were listed as shown in Table 3.8-5, including the Allegheny woodrat, gray bat, Indiana bat, and northern long-eared bat. The Allegheny woodrat is found on rock outcrops, cliffs, talus slopes and crevices. No habitat for the Allegheny woodrat and no roosting habitat for the three bat species (described in Section 3.8.4.1.1.2) is within the JCT Reservation; however, bats may use the area and adjacent Kentucky Reservoir as foraging areas. Review of the TVA RNHD in October 2021 also indicated that no records of caves exist within three miles of the JCT Reservation.

Reptiles
Alligator snapping turtles have been captured in Kentucky Reservoir 1.5 miles from JCT Reservation. Both, the northern pine snake and the western pigmy rattlesnake have been documented approximately 2 miles from JCT. However, given the habitat requirements for these reptile species, none of them are expected to be present on the JCT CT plant site.

Amphibians
The hellbender was the only amphibian identified on the protected species lists for Humphreys County. This species is aquatic and since the potential CT plant location at JCT Reservation does not contain surface waters (Figure 3.6-3), no hellbenders are present.

Plants
Thirteen plant species were listed as state- or federally protected for the JCT Reservation; however, the current land use of the JCT CT plant site precludes the occurrence of protected plant species on this site. Furthermore, field surveys conducted in summer 2019 describe this area as comprising weedy species indicative of disturbed habitats and possessing “no conservation value” with no potential to support state or federally listed plants (TVA 2020a).

Aquatic Species
Fifteen fish and mollusks of conservation concern, listed in Table 3.8-5, were identified on species lists for the JCT Reservation. However, although the JCT Reservation is on the east bank of the Kentucky Reservoir, no surface waters are present within the heavily disturbed CT plant site. Therefore, none of the aquatic species listed in Table 3.8-5 could occur on site.

Insects
Monarch butterflies are listed as a candidate species for federal listing. Habitat preference and life history characteristics of the monarch butterfly are provided in Section 3.8.4.1.1.7 The only undeveloped, open area on the CT plant site consists of a manicured lawn; therefore, it is unlikely that this species would be present on the JCT CT plant site except on a transitory basis.

3.8.4.1.3.3. Gleason Reservation

Fish, wildlife, and plant species under state or federal protection that may be found on or in the vicinity of the Gleason Reservation according to reviewed species lists are summarized in Table 3.8-5. No federally designated critical habitat is located on the Gleason reservation. Based on the NLCD, land use on the Gleason reservation consists primarily of agricultural fields (62.1 percent) and forested areas (34 percent) (Figure 3.10-7). A review of the resource species lists for species of conservation concern resulted in 23 records of state- or federally protected, candidate, or species of conservation concern, however based on habitat requirements, only five of these species have the potential to occur on the Gleason reservation and are discussed below.

Birds

Swainson's warbler is the only protected species of bird listed for Gleason reservation with a status of "deemed of management concern." Swainson's warblers utilize extensive understory thickets in ravines or rich, damp deciduous floodplain and swamp forests (NatureServe 2021). They require areas with deep shade from both canopy and understory cover. The closest report of this species is about two miles from the Gleason reservation along the Middle Fork of the Obion River. The forested area on Gleason reservation does not appear to be located along a large stream or river with a floodplain or associated swamp forest (based on aerial imagery, FEMA floodplains, or NWI), however field surveys have not been conducted and therefore this species cannot be definitively ruled out as absent.

Migratory Bird Species

Thirty-nine species of birds of conservation concern are listed for Bird Conservation Region 27 Southeastern Coastal Plain, which contains the Gleason reservation. Of these 23 species, at least 10 potentially occur with some regularity on or in the immediate vicinity of the Gleason reservation (Table 3.8-10).

Table 3.8-10. Migratory Bird Species of Conservation Concern Potentially Occurring within the Gleason Reservation

Common Name	Scientific Name	General Habitat Description	Habitat Present
Migrant Species (present as spring and fall migrant and/or during winter)			
Bald eagle	*Haliaeetus leucocephalis*	Nest in forested areas adjacent to large bodies of water. For perching they prefer tall coniferous or deciduous trees.	No
Bobolink	*Dolichonyx oryzivorus*	Grasslands, meadows, and hayfields.	Yes
Dunlin	*Calidris alpina*	Tidal flats, beaches, muddy pools; wet tundra in summer. During migration and winter, widespread in coastal habitats; mainly mudflats, but also sand beaches, rocky shores. Inland, occurs on lake shores, sewage ponds, flooded fields.	No
Lesser Yellowlegs	*Tringa flavipes*	Boreal forest habitats, usually near wetlands	No
Pectoral Sandpiper	*Calidris melanotos*	In migration, prairie pools, muddy shores, fresh and tidal marshes; in summer, tundra. Migrants favor grassy places rather than open mudflats. Often seen along grassy edges of shores, at edges of tidal marsh, in flooded fields or	No

Common Name	Scientific Name	General Habitat Description	Habitat Present
		wet meadows.	
Semipalmated Sandpiper	*Calidris pusilla*	During migration along coast found on mudflats in intertidal zone, shallow estuaries and inlets, beaches. Inland, occurs on edges of lakes and marshes next to very shallow water.	No
Breeding Season Migrants (may occur only during the breeding season)			
Eastern Whip-poor-will	*Antrostomus vociferus*	Woodlands with open understory.	Yes
Chimney swift	*Chaetura pelagica*	Open sky, especially over cities and towns.	Yes
Chuck-will's widow	*Antrostomus carolinensis*	Oak and pine woodlands. Breeds in shady southern woodlands of various types, including open pine forest, oak woodlands, edges of swamps.	Yes
Prairie Warbler	*Dendroica discolor*	Various shrubby habitats, including regenerating forests, open busy fields, and Christmas tree farms	Yes
Wood Thrush	*Hylocichla mustelina*	Breeds in mature deciduous and mixed forests, forests with dense understory, and forest edges.	Yes
Black-throated Green Warbler (Wayne's)	*Dendroica virens*	Coniferous and mixed forest regions	Yes
Kentucky Warbler	*Oporornis formosus*	Moist woodlands and forests with dense tangles and shrubs in the understory beneath an overstory tree canopy.	Yes
Prothonotary Warbler	*Protonotaria citrea*	Moist bottomland forests that are seasonally or permanently flooded.	UNK
Grasshopper Sparrow (Northern)	*Ammodramus savannarum perpallidus*	Dry grassland habitat, generally with low to moderate grass height and low percent shrub cover.	Yes
American Kestrel (Southeast)	*Falco sparverius*	Fields and forest edges/fence rows.	Yes
Resident Species (may occur year-round)			
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Deciduous woodlands with oak or beech, groves of dead or dying trees, river bottoms, recent clearings, farmland, grasslands, forest edges and roadsides	Yes
Field Sparrow	*Spizella pusilla*	Old fields and brushy areas.	Yes

UNK = unknown if suitable habitat and potential presence exists on site

Several migratory species of conservation concern may be found on the Gleason Reservation, either attracted to field habitat or the forested area. The condition and type of the forested area is not known, so it is unknown whether suitable habitat exists for some of the species in Table 3.8-9.

3.8.4.1.3.3.1. Mammals

The Indiana bat, northern long-eared bat, and Rafinesque's big-eared bat are listed species with potential for occurrence on the Gleason reservation. Life history characteristics for the Indiana bat and northern long-eared bat are included in Section 3.8.4.1.1.2. Rafinesque's big-eared bat prefers forested areas with caves and rock shelters for winter roosts. For summer roosts, it prefers a variety of habitats including abandoned buildings, hollow trees, areas under bridges or in culverts near wooded areas (NatureServe 2021). Depending on the type and condition of trees on site, the deciduous forest on southern portion of Gleason reservation may provide potential summer roosting habitat for these bat species and open areas may provide foraging habitat; therefore, these species may be present.

3.8.4.1.3.3.2. Plants

Four species of plants were listed as state threatened or endangered for the Gleason reservation, with an additional two species listed as state species of concern (Table 3.8-5). No federally listed plants were identified from the IPaC database. Of these listed plant species, three may have habitat on site: Halberd-leaf tearthumb, Harbison's hawthorn, and red turtlehead. Both Halberd-leaf tearthumb and red turtlehead are associated with wetland habitats; while the NWI did not identify wetlands on the Gleason reservation, the NLCD classified the forested area as "woody wetlands." Field surveys will be completed to confirm presence or absence of wetland habitat on site prior to construction activities if this Action Alternative is selected. Like these wetland species, it is unknown whether Harbison's hawthorn (which is found in dry, rocky calcareous woods) could be present on the Gleason reservation, pending field surveys of the forested area on the southern portion of the proposed CT plant site.

3.8.4.1.3.3.3. Aquatic Species

Three species of fish (one state- and federally listed, and one species Deemed in Need of Management) and one crayfish were identified on the resource species lists for the Gleason reservation (Table 3.8-5).

The two listed fish species, the firebelly darter and the piebald madtom, occupy small to medium-size streams and rivers (Etnier and Starnes 1993, NatureServe 2021). According to the NHD, the only stream on the Gleason reservation is intermittent (Figure 3.6-4) and not suitable habitat for fish which inherently require waterbodies with permanent flow regimes.

The Hatchie burrowing crayfish uses saturated or seasonally saturated soils associated with permanent bodies of water in Mississippi River tributaries and the Coastal Plain (USACE 2021). Habitat for this species may exist within the intermittent stream channel on the Gleason reservation if this stream remains sufficiently saturated.

3.8.4.1.3.3.4. *Insects*

Monarch butterflies were listed as potentially present for Gleason reservation according to the IPaC database. Details on the Monarch butterfly are included in 3.8.4.1.1.7. As stated previously, the cultivated crop areas on Gleason reservation consist of weedy, early successional and ruderal vegetation types typical of abandoned agricultural fields such as Bahai grass, broomsedge, crabgrass, Dallas grass, purple sprangle top, redtop panic grass, and signal grass. These areas may also support flowering plants and/or milkweed, which is a host plant for this species.

3.8.4.1.3.4. Transmission Corridors

Based on a desktop review of the proposed 40-mile TL corridor, land use along the TL consists of primarily agricultural land with a small proportion of forested areas (see Section 3.10.2.3.3).

Bodies of water, such as wetlands, streams, and ponds, are also present (see Sections 3.6.2.1.3.3 and 3.6.3.1.3.3). If this alternative is selected, field surveys would be performed along the TL corridor after siting finalization to determine if protected plant and animals are present in the proposed action area.

3.8.4.1.4. Alternative C

3.8.4.1.4.1. Middle Tennessee TVA Power Service Area

There is a wide range of species of conservation concern that may occur in the Middle Tennessee TVA PSA due to the variable, and sometimes rare, habitat types and vegetation communities. Protected species such as vertebrates as small as cave-dwelling bats and salamanders, invertebrates such as mussels, and a variety of plants can be found in this region (Bryant et al. 1993). Some of the highest concentrations of federally listed threatened or endangered species are found in the Interior Low Plateau ecoregion (TVA 2019b), which includes the Western Highland Rim, Eastern Highland Rim, Outer Nashville Basin, and Inner Nashville Basin (Griffith et al. 1997). The taxonomic groups with the highest proportion of species listed under the ESA are fish and mollusks. Factors contributing to the high proportions of vulnerable species in these groups include the high number of endemic species in the TVA region and the alteration of their habitats by reservoir construction and water pollution. River systems with the highest numbers of listed aquatic species include the Tennessee, Cumberland and Coosa rivers.

Conservation efforts have successfully downgraded or removed some species from the ESA list in Tennessee, such as bald eagle. Conversely, some species have been added to federal and state listings due to declines driven by development/habitat loss, introduced pathogens (e.g., white nose syndrome) or other causes (Bryant et al. 1993; TVA 2019b). If this alternative is selected, field surveys would be performed at all facility locations and associated transmission corridors to determine if protected plant and animals are present in the proposed action area.

3.8.4.2. Environmental Consequences

3.8.4.2.1. The No Action Alternative

Under the No Action Alternative, CUF would continue operations. TVA would implement all of the planned actions related to the current and future management and storage of CCRs. As a result, no new work would be conducted that could potentially alter project-related environmental conditions within the plant. Therefore, no new effects on threatened or endangered species, or species of conservation concern or any suitable habitat would occur under this alternative.

3.8.4.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Under any Action Alternative, CUF would be decommissioned. The species discussed under this Action Alternative may be present within the demolition boundary. Vegetation communities to be impacted within the demolition boundary primarily consists of ruderal open areas, which does not significantly support any protected terrestrial species. However, roadside ditches or unmowed areas where herbaceous flowering plants have grown could offer small amounts of foraging habitat for monarch butterfly. However, removal of this extremely small amount of foraging habitat would have no significant effect on monarch butterflies. Actions would not jeopardize the continued existence of this species. Other vegetation that could be removed would primarily consist of ornamental landscaping immediately surrounding buildings proposed for demolition. These areas do not offer suitable summer roosting habitat for federally protected bats.

In addition, 11 known osprey nests and a colony of cliff swallows fall within the demolition boundary. Actions that rise to disturbance levels above typical, demonstrated tolerance levels will be performed when ospreys are not actively nesting. Deconstruction and demolition activities have the potential to disturb and/or displace osprey nesting in the area. While osprey nests are active (typically between March 1st and July 31), no loud, sustained disturbances are allowed within 660 feet of the nest. Limited activities such as vegetation maintenance (bushhogs, mowers, and selective herbicide application) are allowed due to the short-term minimal disturbance caused by these actions. Should there be a potential for effects to nesting osprey TVA will coordinate with USDA-Wildlife Services to ensure compliance with federal law. Other birds nesting around the CUF site are acclimated to frequent, loud disturbances caused by the functioning of CUF. None of the proposed actions would directly affect the bridge where cliff swallows are nesting. With adherence to seasonal restrictions around osprey nests and/or coordination with USDA-Wildlife Services, proposed actions for the retirement of the CUF plant would not significantly affect populations of common wildlife species.

Prior to demolition, internal survey of the buildings proposed for demolition and on-site bridges would occur to ensure no colonies of bats or other migratory birds have been established while buildings are inactive. Should bats or birds be observed in the construction area, avoidance and minimization measures (such as seasonal restrictions) would be implemented and consultation with the appropriate state or federal agencies (USDA, USFWS, TWRA) would be conducted. With these precautionary measures, no direct effects would be expected to protected bat species or colonies of migratory birds.

In September 2017, TVA completed a programmatic biological assessment (BA) to address the potential for impacts of specific TVA actions on federally listed bat species whose ranges overlap with the TVA action area. The BA addresses 10 overarching actions and 96 routine activities that TVA authorizes, funds, or carries out, and how these actions and activities may affect the Indiana bat, northern long-eared bat, gray bat, and Virginia big-eared bat. TVA determined that 21 of the 96 routine activities would have no effect on these listed bat species or their critical habitat. On March 8, 2018, the USFWS responded to the BA with concurrence that the remaining 75 routine activities are not likely to adversely affect the gray bat, Virginia big-eared bat, or critical habitat of the Indiana bat. The USFWS also agreed that 72 of the 96 proposed routine actions are not likely to adversely affect the Indiana bat or northern long-eared bat. On April 12, 2018, the USFWS provided a biological opinion (BO) regarding the remaining three activities that could result in adverse effects to Indiana bat and northern long-eared bat (vegetation removal, hazard tree removal, and prescribed burning) that concluded that “the action is not likely to jeopardize the continued existence of the Ibat [Indiana bat] or the NLEB [northern long-eared bat]”. In addition, the BO also included an Incidental Take Statement which defined the “action is reasonably certain to cause incidental take of individual Ibats [Indiana bats]”. Due to the difficulty of detecting the take of Indiana bats, TVA must quantify the extent of take by using the annual and 20-year cumulative acreages of tree removal and prescribed burning under the programmatic action as a surrogate measure, as defined in the BO.

Several activities associated with this action (i.e., building demolition, blasting, grading) were addressed in TVA’s programmatic consultation with the USFWS on routine actions and federally listed bats. For those activities with potential to affect bats, TVA committed to implement specific conservation measures when direct and indirect effects to federally listed bat species are expected. Relevant conservation measures to this project are listed in a bat strategy form and must be reviewed and implemented as part of the approved project. Given the lack of effects to known roosting habitat and identified conservation measures, proposed project activities would not significantly affect gray bat, Indiana bat, or northern long-eared bat. Use of these same

conservation measures would also ensure the tricolored bat would not be significantly affected and that proposed actions would not jeopardize the continued existence of tricolored bat.

Conservation measures identified in the bat strategy form include:

- Projects that involve structural modification or demolition of buildings, bridges, and potentially suitable box culverts, will require assessment to determine if structure has characteristics that make it a potentially suitable unconventional bat roost. If so a survey to determine if bats may be present will be conducted.
- Additional bat P/A surveys (e.g., emergence counts) conducted if warranted (i.e., when AR1 indicates that bats may be present).
- Operations involving chemical/fuel storage or resupply and vehicle servicing will be handled outside of riparian zones (streamside management zones) in a manner to prevent these items from reaching a watercourse. Earthen berms or other effective means are installed to protect stream channel from direct surface runoff. Servicing will be done with care to avoid leakage, spillage, and subsequent stream, wetland, or ground water contamination. Oil waste, filters, other litter will be collected and disposed of properly.

There is potential for the alligator snapping turtle to be present in the Cumberland River within the demolition boundary; however, no nesting habitat falls within this disturbance area. Therefore, no effects to the alligator snapping turtle are expected for the retirement of the CUF plant.

Blue sucker and the alligator snapping turtle were the only listed aquatic species with potential to be found near CUF based on required habitat and on prior surveys confirming the presence of blue sucker. If the blue sucker is in the vicinity when D4 activities commence, it is likely that the fish will leave the area due to disturbance. It is unlikely that direct harm would occur. As described in Section 3.6.2.2.2, appropriate BMP measures would be implemented as a condition of USACE and TDEC permits to minimize any affects to species or habitats within or in the vicinity of the demolition area. No significant effects to habitat for this species would occur as a result of demolition work (i.e., mooring removal, shoreline barge facilities, etc.). No other suitable habitat for state- or federally listed aquatic species occurs within the demolition boundary (Figure 3.6-1); therefore, direct effects to state- or federally listed threatened and endangered aquatic species are not anticipated to occur from CUF retirement. Additionally, water discharges would continue to meet existing NPDES permit requirements, which are designed to be protective of aquatic life in receiving waters. Therefore, effects on listed fish and shellfish species near CUF are not anticipated.

The terrestrial habitat onsite is currently disturbed land comprised of fill material, which is generally unsuitable habitat for listed plant species identified for CUF Reservation. As stated, vegetation communities (as defined during the 2021 field surveys) within the demolition boundary primarily consist of ruderal open areas, which does not support any protected botanical terrestrial species; therefore, no impact is expected to state-protected plant species

Cumulative effects to threatened and endangered species are not anticipated as CCR management activities on the CUF Reservation have completed Section 7 consultation and would adhere to conservation and mitigation measures.

3.8.4.2.3. Alternative A

3.8.4.2.3.1. Construction and Operation of CC Plant at CUF

The proposed construction of a CC plant would require disturbance and/or clearing of disturbed fields (former agricultural fields) and small areas of trees (Figure 3.8-1). Species that could experience habitat loss due to this action alternative include Alligator snapping turtle, Bewick's wren, Henslow's sparrow, western pygmy rattlesnake, monarch butterfly, Indiana bat, northern long-eared bat, gray bat, and tricolored bat which may use these habitats; however, none of these species were observed during terrestrial wildlife and wetland surveys in 2021. No effects to protected plant species or mussel species are expected as no threatened or endangered species or their habitats were observed within the CC plant boundary during the 2021 field survey.

Individual Bewick's wrens and western pygmy rattlesnake could be directly impacted by the proposed actions, should they occur in the action area at the time of vegetation removal and are immobile (i.e., juveniles, eggs, hibernation). Henslow's sparrows do not breed in this area of Tennessee and are only seen here rarely during migration or winter. Any individuals moving through the area would be expected to avoid active construction areas and flush if disturbed. Bewick's wren's nest in cavities in outbuildings, old mailboxes, brush piles, or tree cavities. Human dwellings and associated refuse do not occur in the action area. Trees in the area do not have abundant nesting cavities. Pigmy rattlesnakes are "not frequently encountered in Tennessee" though "they are common in some small areas" (Neimiller and Reynolds 2011). None of these species were observed on site during field surveys. Neither of the bird species have been reported from this area on the public eBird (a large-scale citizen-science observation reporting platform, https://ebird.org/home) since observations were first recorded in 2011. TVA and TDEC natural heritage databases do not have records of any of these species occurring in the action area or within a 3-mile radius. The majority (72 percent) of the habitat impacted under Alternative A would be temporarily impacted. The scattered trees and fence rows would be removed under proposed transmission lines, but areas of herbaceous vegetation along these lines would only be impacted temporarily for transmission structure installation, access roads, and laydown areas. Following actions, these areas are currently expected to return to herbaceous fields. Therefore, permanent impacts to habitat due to clearing or permanent habitat conversion would be approximately 52.4 acres under this alternative. Mobile adults would be expected to flee if disturbed. Suitable habitat is present in the adjacent landscape such that dispersed individuals would be able to find food and shelter nearby. These individuals would be expected to repopulate the site following the completion of activities. Due to the temporary nature of the majority of the impacts, the relatively small area to be permanently impacted, the availability of similarly suitable habitat nearby, minimal nesting habitat for Bewick's wren, and rare presence of Henslow's sparrow during non-breeding seasons only, proposed actions would not affect populations of Bewick's wrens, Henslow's sparrows, or western pygmy rattlesnake.

The majority (113.5 acres, or 74.0 percent) of the impact footprint area for the CC plant (including transmission line corridors) is classified as low-quality summer roosting bat habitat for Indiana bat and northern long-eared bat, meaning any trees present are too small or young, or otherwise do not possess characteristics suitable for roosting. However, they are suitable for foraging over and around. Old fence rows lined with trees within the disturbed fields were classified as medium-quality bat roosting habitat that totals 37.5 acres (24.5 percent). Small areas of fragmented forest within proposed transmission ROWs were classified as high-quality summer roosting habitat (2.32 acres, 1.5 percent). The areas of moderate and high-quality summer roosting habitat identified for Indiana bat and northern long-eared bat may also be suitable for summer roosting by the proposed endangered tricolored bat. Permanent impacts to bat habitat include clearing for development or habitat conversion (from forested to herbaceous)

in transmission line corridors. Temporary impacts to bat habitat total 37.6 acres of low-quality habitat and 8.7 acres of medium quality habitat for the construction laydown and support areas.

Tree removal at the CC plant site would occur between November 15 and March 31 when listed and proposed listed bat species are not expected to be roosting. No roosting habitat for gray bat exists in the CC Plant area. Foraging habitat for gray bat, Indiana bat, northern long-eared bat, and tricolored bat exists over fields, forests, and bodies of water including Wells Creek and the Cumberland River. Avoidance measures and BMPs would minimize impacts to bodies of water.

Monarch butterfly is currently listed under the ESA as a candidate species and is not subject to Section 7 consultation under the ESA. The majority of the proposed CC plant site is comprised of disturbed fields with common species including Johnson grass, sericea lespedeza, and other common native and non-native herbaceous species. Areas with proposed transmission construction and upgrades contain existing TVA ROWs which provide a wider variety of herbaceous species, several of which provide suitable foraging habitat for monarchs. Milkweed were not a dominant species observed or recorded on the CUF. Existing ROWs would not be impacted by proposed actions except at discrete locations where new structures may be placed. Forest conversion to herbaceous habitats for new transmission ROWs would be seeded with native grasses and/or noninvasive vegetation which would provide more flowering plants than previously occurred in these areas. Proposed actions would not significantly impact monarch butterfly and would not jeopardize its continued existence.

Potentially suitable foraging and nesting habitat for alligator snapping turtle exists in and around Wells Creek. However, none of the known records known form Stewart County are nesting records and all records are greater than 3 miles from CUF. Impacts to surface waters and associated shorelines at the CUF would be minimized by avoidance measures and BMPs. While some habitat conversion (tree removal and replanting with herbaceous plant mixes) could occur near Wells Creek in isolated locations for creation of transmission line rights-of-ways, the majority of actions would be temporary for access roads or laydown areas. Proposed actions would not significantly impact alligator snapping turtle nor would it jeopardize the continued existence of this species.

See Section 3.8.4.2.3.4 for discussion of Section 7 ESA consultation and compliance associated with these actions and additional bat conservation measures. With the use of BMPS, conservation measures, and winter tree removal, significant impacts to gray bat, Indiana bat, and northern long-eared bat would not occur.

Tree removal at the CC plant site would occur between November 15 and March 31 when many migratory birds of conservation concern would not be nesting, thereby minimizing impacts for most species. Due to the temporary nature of the majority of impacts, relatively small size of the area to be permanently affected, significant effects to migratory bird populations are not anticipated.

Cumulative effects to threatened and endangered species are not anticipated as CCR management activities on the CUF Reservation have completed Section 7 consultation and would adhere to conservation and mitigation measures. Further Section 7 consultation with USFWS would be required if (1) new information reveals impacts of an action that may affect listed species or critical habitat in a manner not previously considered, (2) the action is subsequently modified to include activities which were not considered during the original consultation, (3) new species are listed or critical habitat designated that might be affected by the action, or (4) the amount or extent of expected take of suitable bat habitat is exceeded.

3.8.4.2.3.2. Construction and Operation of Natural Gas Pipeline

Of the protected species evaluated from the IPaC and RNHD resource lists, only protected plant species and bats have potential habitat present with in the natural gas pipeline corridor. Furthermore, the gray bat and tricolored bat were the only protected species actually observed during resource (i.e., plant, bat, mussel) surveys.

As stated in TGP's Resource Report 3 (TGP 2022c):

> TGP anticipates that primary construction impacts would be the cutting, clearing, and/or removal of existing vegetation that provides migratory bird habitat within the construction work areas. These actions could remove nesting habitat and could impact migratory birds through the loss of nests (including those with eggs and/or young), possible loss of migratory birds themselves, reduction in migratory bird productivity, and displacement or loss of second nesting opportunities.

Approximately 282 acres of habitat (51 percent upland forest, 48 percent herbaceous, and 1 percent scrub habitat) would be temporarily disturbed from construction activities (see Table 3.8-2). Temporary affects in herbaceous and scrub habitat would be short-term, resulting in temporary displacement of wildlife and protected species using these areas, including migratory bird species. In forested areas, the regeneration time following completion of construction activities results in a longer-term impact than in herbaceous or scrub habitat. This leads to a long-term affect to species relying on forested habitats, such as summer roosting habitat for the tri-colored bat or nesting of some migratory bird species (TGP 2022c).

Permanent impacts include the loss of habitat from facility operations (e.g., the pipeline, pressure regulating stations, access roads, etc.). These impacts total 185 acres of habitat comprising 63 percent upland forests, 36 percent herbaceous, and 1 percent scrub habitats. These impacts result in the permanent displacement of wildlife and protected species using these areas.

TGP Resource Report 3 (TGP 2022c) states:

> TGP has consulted with USFWS and TWRA regarding mitigation measures for work in protected species habitat. At this time, TGP anticipates that mitigation will include the following measures, at a minimum:
>
> - Developing a contractor training program to educate all construction personnel on species life history, identification, and protection protocols;
> - Covering excavations, holes, or trenches created during construction overnight or inspecting them every morning to ensure no wildlife have been trapped;
> - Conducting operational ROW vegetation management and operations and maintenance of [pipeline] facilities in accordance with the FERC Plan and FERC Procedures (with requested deviations);
> - Minimizing long-term habitat impacts by co-location of pipeline with existing utility ROWs; and

- In accordance with USFWS recommendations to minimize impacts to migratory birds pursuant to the MBTA and protected bats, TGP will conduct tree clearing for [pipeline] construction and maintenance mowing during operations from October 15 to March 31. If tree clearing is required outside this window to accommodate construction, the necessary MBTA and bat surveys/consultations (including consultation with USFWS and TWRA) will be made.

- In accordance with the USFWS recommendations, TGP will revegetate the Project area in a manner that maximizes benefits to pollinators. TGP will use approved NRCS native seed mixtures.

> Any migratory bird species that solely rely on large, unfragmented tracts of forested habitat most likely do not utilize the habitat in the vicinity of the [pipeline] due to the presence of TVA's powerline easement, other utility ROWs, and the periodic vegetation maintenance activities conducted thereon. Subsequently, no additional impacts on migratory bird populations or behaviors are anticipated as a result of the proposed [pipeline]. Conversely, migratory bird species that utilize edge habitats may benefit from the effects of construction clearing and maintenance activities

TGP Resource Report 1 (TGP 2022a) states:

> [The USFWS recommended] that clearing of trees and maintenance mowing be conducted during the period of October 15 to March 31 to the greatest extent practicable (while adhering to standard sediment control measures during the rainy season) or, at a minimum, to conduct these activities as late in summer as practicable (see TGP 2022a, Appendix 1.F). TGP is requesting issuance of a certificate order for the [pipeline] in November 2023 and, following receipt of all applicable approvals, anticipates beginning construction activities that do not require tree felling in August 2024, felling and clearing trees from the [pipeline] construction workspace beginning mid-October 2024, and commencing all remaining construction activities by November 2024.

As stated in Resource Report 3 (TGP 2022c):

> To comply with the MBTA (16 USC 703–712), if an active nest is located before or during construction, measures would be taken to avoid destroying the nest and violating the MBTA. Measures to protect migratory birds, active nests, and their habitats during [natural gas pipeline corridor] construction and operation include:
>
> - Conducting vegetation clearing for [pipeline] construction outside of the nesting season to discourage nest establishment in impacted areas, when possible;
> - Conducting operational (routine maintenance) vegetation clearing from October 15 to March 31, which is outside the greater nesting bird season, when possible;
> - Conducting pre-construction migratory bird nest surveys by qualified biologists prior to initiating construction activities if vegetation clearing must occur within the nesting season;

- Identifying active nests within areas to be cleared plus a 10-foot buffer adjacent to affected areas by a qualified biologist when migratory bird habitat cannot be avoided during nesting season;
- Consulting with the USFWS Cookeville Ecological Services Field Office to obtain additional guidance on conducting surveys if active bird nests are found;
- Deferring work activities within the designated 10-foot buffer zone of an active nest until young have fledged, if possible, with the exception of motor vehicle traffic on previously existing public or private roads where this activity does not generate noise levels or disturbance such that it could result in take;
- Using a licensed bird rehabilitation facility to facilitate removal of eggs and/or young birds from an active nest if it is determined in consultation with the USFWS that eggs and/or young birds need to be removed from an active nest;
- Grading areas that would not be encumbered by permanent aboveground facilities to match pre-construction contours and drainage patterns to the extent practicable;
- To the greatest extent feasible, the proposed pipeline route is co-located parallel and adjacent to an existing powerline easement;
- Adherence to the measures outlined in the FERC Plan and FERC Procedures (with requested deviations) during construction and operation of the Project facilities; and
- Having an Environmental Inspector present during the construction of the [pipeline].

The [cumulative impacts assessment area] for cumulative impacts on protected species includes lands within one mile of the [pipeline] workspaces. TGP has consulted with USFWS and TWRA regarding mitigation measures for work in protected listed species habitat. Based on the results of this consultation, TGP will adhere to the applicable restrictions required by the USFWS and TWRA.

In accordance with the basic assumptions of the cumulative impacts […] and because [pipeline] activities are anticipated to have minor or insignificant impacts, the cumulative impacts resulting from the [pipeline] will be minor or insignificant. Based on the anticipated restoration and mitigation efforts and adherence to recommendations and specific conservation measures, no significant incremental contributions to cumulative impacts on protected species are anticipated to be associated with the [pipeline]. The [pipeline] also will not contribute to cumulative impacts associated with past/historical, present, or reasonably foreseeable future projects or activities.

TVA reviewed and concurs with TGP's conclusions regarding potential pipeline project effects to threatened and endangered species.

3.8.4.2.3.3. Transmission and Other Components

Potential habitat for several protected species exists within the transmission line area. Direct effects could occur to immobile individuals that are present during vegetation removal and grading. As with the natural gas pipeline lateral, mobile species are likely to leave the area once construction activities commence and may return upon completion of the project if habitat is appropriate. While species associated with forested habitat may leave areas cleared for the transmission line area, species associated with early successional or field habitat may colonize the area following construction (or after regrowth). Field surveys would be conducted within the off-site transmission line work area prior to construction. Should listed species be found, avoidance and minimization measures would be put in place and state agencies would be contacted or Section 7 consultation with USFWS would occur as appropriate to ensure this aspect of the project does not significantly affect federally protected plant or animal species.

Summer roosting habitat and foraging habitat for listed and proposed bats likely exists within the transmission line area. It is estimated that up to three acres of suitable bat roosting and foraging habitat could be removed to accommodate access roads to OPGW transmission lines. Nine caves are known within three miles of the transmission upgrades. No currently federally listed bat species are known from any of these caves. Foraging habitat and sources of drinking water for gray bat, Indiana bat, and northern long-eared bat likely exist in rivers, streams, and potentially wetlands along the ROW with proposed transmission upgrades. TVA will conduct comprehensive field surveys of the proposed transmission upgrades and any associated access roads once the full scope of the transmission upgrades has been finalized. Should any previously unknown caves or other documented roosting sites be identified during field surveys TVA would reinitiate Section 7 consultation.

The following avoidance and minimization measures would be implemented during transmission upgrades to minimize affects to federally listed bat species:

- Best management practices would be put in place around all water bodies to minimize impacts to hydrology and water quality.
- Suitable summer roosting habitat for Indiana bat and northern long-eared bat would be removed between October 15 and March 15 when bats are not likely to be roosting out on the landscape.
- Drilling or blasting within a 0.5-mile radius of documented cave would be conducted in a manner that would not compromise the structural integrity or alter the karst hydrology of the cave.

See Section 3.8.4.2.3.4 for discussion of Section 7 ESA consultation and compliance associated with these actions and additional bat conservation measures. With the use of BMPS, conservation measures, and winter tree removal, significant impacts to gray bat, Indiana bat, and northern long-eared bat would not occur.

Some actions near nesting osprey and colonial nesting bird colonies are prohibited while birds are actively nesting. Five osprey nests and a cormorant nesting colony are located within the proposed transmission line area on the CUF Reservation (Figure 3.8-2), and osprey nests may be located on existing structures along the OPGW transmission line. Actions that rise to disturbance levels above typical, demonstrated tolerance levels will be performed when ospreys and/or cormorants are not actively nesting (between March and July). A survey for osprey nests along the OPGW would be conducted prior to installation. Should there be a potential for effects

to nesting osprey along the transmission line area or the OPGW transmission line, TVA will coordinate with USDA - Wildlife Services to ensure compliance with federal law.

As discussed in prior sections addressing effects to habitats due to transmission line or natural gas pipeline corridor maintenance, routine vegetation management of the transmission line would be required to assure safe and reliable transmission facilities. Management activities likely include herbicide treatment and mowing to control vegetation growth through the ROW (TVA 2018b). Protected species, if present, are expected to be displaced intermittently in conjunction with the presence of maintenance crews and the alteration of habitats. Over time, wildlife would become habituated to the herbaceous habitat of the transmission line area and those species associated with fields or early successional habitat may be found in the corridor.

3.8.4.2.3.4. Summary of Alternative A

No impacts to protected plant or mussel or crayfish species are expected due to the construction and operation of the CC plant. Minor impacts to Bewick's wren, Henslow's sparrow, or western pygmy rattlesnake could occur if present in the action area at the time of vegetation removal. Mobile individuals would move out of the area due to disturbance, but immobile species (juveniles, eggs, or those in hibernation) could be impacted. None of these species have been observed at CUF Reservation during surveys. Due to the temporary nature of the majority of the impacts, the relatively small area to be permanently impacted, the availability of similarly suitable habitat nearby, minimal nesting habitat for Bewick's wren, and rare presence of Henslow's sparrow during non-breeding seasons only, proposed actions would not affect populations of Bewick's wrens, Henslow's sparrows, or western pygmy rattlesnake.

Due to the small amount of potential nesting habitat or host plants to be impacted, proposed actions would not significantly affect alligator snapping turtle or monarch butterfly.

Approximately 39 acres of suitable summer roosting habitat for Indiana bat, northern long-eared bat, and tricolored bat would be removed at the proposed CC plant area. An additional 3 acres of suitable roosting habitat has the potential to be removed along proposed transmission upgrade areas. All tree removal would occur from November 15-March 31 and no impacts to caves or documented winter roosting habitat would occur with adherence to conservation measures.

Field review of the transmission areas would occur when the full scope of these upgrades has been finalized. A desktop review of the transmission line ROW and surrounding vicinity indicates that the specialized habitat required by these plant species is unlikely to occur in the proposed work areas. In addition, topographic maps and aerial photos indicate that no river bluffs or cedar glades occur within the potential action area. Given that field surveys have not yet occurred, TVA conservatively determined there could be effects to federally listed plant species. Should listed species be found, avoidance and minimization measures would be put in place and state agencies would be contacted or Section 7 re-consultation with USFWS would occur as appropriate to ensure this aspect of the project does not significantly affect federally protected plant or animal species.

On May 4, 2022, TVA requested concurrence from USFWS under Section 7 of the ESA for the "may affect not likely to adversely affect" determinations for CUF retirement, CC Plant Construction, and transmission upgrades. TVA determined that proposed actions would not affect bald eagle, pink mucket, rabbitsfoot, tan riffleshell, yellow-blossom pearlymussel, Cumberland combshell, orangefoot pimpleback, pink mucket, and ring pink, and Nashville crayfish. TVA determined that proposed actions may affect but are not likely to adversely affect

Braun's rockcress, leafy prairie-clover, Price's potato-bean, Pyne's ground plum, Short's bladderpod, and gray bat. TVA also notified the USFWS of use of "Take" from the Biological Opinion for TVA's programmatic consultation with the USFWS on routine actions that may affect endangered or threatened bats. Finally, TVA determined proposed actions would not jeopardize the continued existence of alligator snapping turtle, and monarch butterfly. On July 20, 2022, a letter of concurrence was received by the USFWS in response to TVA's Section 7 consultation On August 26 2022, USFWS concurred with design changes and minor additions to tree removal estimates, indicating that approximately 42.89 acres of "Take" for suitable bat habitat tree removal during the winter season will be used from TVA's programmatic consultation with USFWS in association with this project. The USFWS letter of concurrence is included in Appendix K along with the Bat Strategy Project Screening form that identifies conservation measures that apply to this project.

Since the above consultation with USFWS, the tricolored bat has been proposed for listing as endangered under the ESA. While suitable summer roosting habitat would be removed, it would be done during winter when this species would not be out on the landscape. Furthermore, no impacts to hibernacula would occur due to aforementioned commitments and conservation measures. Proposed actions would not significantly impact this species nor would they jeopardize the continued existence of the species.

A survey for osprey nests along the transmission line corridor would be conducted prior to initiation of construction activities. With avoidance measures in place and coordination with USDA – Wildlife Services when necessary, significant impacts to osprey and colonial nesting bird colonies are not anticipated at the CUF plant or in proposed transmission upgrade areas.

Surveys were conducted for protected plant species (during the appropriate blooming season), bats, and mussels; however, the gray bat and tricolored bat were the only protected (or proposed-protected) species observed in the pipeline corridor. As a year-round cave dweller, the gray bat is unlikely to be disturbed or harmed during clearing and construction activities. The tricolored bat, currently proposed for federal listing, uses mature trees and snags for summer roosting; therefore this species could experience impacts from long-term, temporary (145 acres) and permanent (116 acres) habitat loss from clearing of forested areas for construction or operational purposes of the natural gas pipeline. However, the creation of an expanded or new pipeline corridor with appurtenant facilities would provide open areas suitable for foraging for both bat species. On March 10, 2022, the USFWS provided concurrence on TGP's effects determinations on the gray bat, Indiana bat, northern long-eared bat, rabbitsfoot, tan riffleshell, Price's potato-bean, and Short's bladderpod.

The USFWS stated, "based on location of the project site, survey findings, and implementation of conservation measures as discussed, the Service [USFWS] concurs with your [*not likely to adversely affect*] determinations for each of the seven species" (TGP 2022a, Appendix 1.F). The USFWS also noted that "negative bat survey results are valid for a period of five years unless new information suggests otherwise."

Recommendations made by the USFWS include clearing of trees and maintenance mowing from October 15 to March 31 to the greatest extent practicable and revegetating disturbed areas in a manner that maximizes benefits to pollinators (e.g., milkweed species to enhance habitat for the monarch butterfly) (TGP 2022a, Appendix 1.F).

Overall, impacts to protected species from the CC plant are minor, short-term, and/or periodic. Impacts to protected species from the natural gas pipeline are primarily caused by clearing for the pipeline corridor, resulting in a reduction in summer roosting habitat. Nearby or adjacent

forested areas may provide habitat as an alternative during the summer season. No direct impacts would be felt by the tricolored bat during the winter period when hibernating in caves. Risk and impacts to protected species is minimized through appropriate consultation with the agencies, best management practices (minimization and conservation measures) and guidelines.

3.8.4.2.4. Alternative B

3.8.4.2.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Although two protected bird species have been identified within two miles of JCT Reservation, it is unlikely they would be present on the proposed CT plant site. Piping plovers are a rare fall and spring migrant in Tennessee. Suitable habitat for this species does not exist in the action area at the proposed CT site. Similarly, no suitable habitat for little blue heron is present in the proposed CT site on the JCT Reservation. Neither piping plover nor little blue heron would be impacted by the CT construction and operation.

Because the proposed CT plant at the JCT Reservation would be located on previously developed land, there would be no effects to most state- or federally protected species. Foraging habitat for bats and birds exists over water around the JCT Reservation boundary and BMPs would be implemented (as a requirement of associated permits) near these bodies of water to minimize effects to these habitats and resources.

Osprey may be disturbed during construction activities due to noise. Actions that rise to disturbance levels above typical, demonstrated tolerance levels will be performed when ospreys are not actively nesting. While the osprey nest is active (typically between March 1st and July 31), activities within 660 feet of the nest are limited to vegetation maintenance (bushhogs, mowers, and selective herbicide application only). Should there be a potential for effects to nesting osprey TVA will coordinate with USDA – Wildlife Services to ensure compliance with federal law.

Noise disturbance also has potential to disrupt a red-tailed hawk nest located outside of the JCT Reservation boundary, however due to the distance away from proposed actions, this nest is not expected to be impacted.

Cumulative effects to threatened and endangered species are not anticipated as Section 7 consultation for the proposed adjacent Aeroderivative CT project on JCT was completed and effects would be minor. Both CT plant sites have been previously disturbed and neither provides habitat for diverse wildlife species. The potential for cumulative effects is further minimized by conducting pre-construction surveys for osprey nests and coordination with USDA- Wildlife Services to ensure compliance under the EO 13186 [Responsibilities of Federal Agencies to Protect Migratory Birds], if needed. In addition, several activities associated with this action were addressed in TVA's programmatic consultation with the USFWS on routine actions and federally listed bats in accordance with Endangered Species Act Section 7(a)(2), completed in April 2018. For those activities with potential to affect bats, TVA committed to implement specific conservation measures when effects to federally listed bat species are expected.

3.8.4.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

Several migratory species of conservation concern could be present on the Gleason reservation. Depending on the timing of vegetation removal direct and indirect effects to migratory birds of conservation concern could occur. Similar effects could occur to Swainson's warbler should the species be present on site. Should migratory birds occur within the CT plant

site at the time of tree removal or construction, those that are mobile are expected to flee if disturbed.

The forested habitat on the southern portion of Gleason reservation may contain summer roosting habitat for bat species, and the open fields can function as foraging grounds for these species, as well. Removal of suitable summer roosting habitat for federally listed bats would require consultation with USFWS under Section 7 of the Endangered Species Act. However, such tree removal is an activity that was addressed in TVA's programmatic consultation with the U.S. Fish and Wildlife Service on routine actions and federally listed bats in accordance with Endangered Species Act Section 7(a)(2), completed in April 2018. For those activities with potential to affect bats, TVA would commit to implement specific conservation measures when scope is final and effects to federally listed bat species can be determined.

Three protected species of plants may be found on Gleason reservation, either in the field habitat or in the forested area on the southern part of the site. Field surveys would be completed prior to any construction activities and Section 7 consultation with the USFWS would be conducted. If protected species are present, avoidance and minimization measures would be needed with possible relocation of individual plants to nearby suitable habitat.

If the stream on the Gleason reservation is intermittent, no fish are expected to be present within this waterway, however conditions may be suitable for the Hatchie crayfish. Field investigations complete with delineation and hydrologic determination data forms and appropriate USACE and ARAP/TDEC permits would be completed prior to commencement of construction activities in order to minimize effects to this species and habitat if present. As a part of this process, measures would be taken to avoid and minimize effects to aquatic resources to the maximum extent practicable.

There is possibility for the candidate species, monarch butterfly, to occur on site if host plants exist in the field area. A field survey of vegetation in this area would be conducted prior to construction to determine whether suitable habitat is present for this species. At this time Monarch butterfly is listed as a candidate species under the ESA and not subject to Section 7 consultation.

Cumulative effects to threatened and endangered species at Gleason would not occur.

3.8.4.2.4.3. Transmission and Other Components

Based on a review of 298 transmission line projects from 2005 to 2018, 32 of 256 projects (11 percent) affected federally listed threatened or endangered species or species proposed or candidates for listing (Table 3.3-1). Of 290 projects review, 63 (22 percent) projects affected state-listed endangered, threatened, or special concern species. Habitat and species surveys would be required for the proposed 40-mile transmission line. Depending on the results of the field surveys, USFWS consultation may be required under supplemental NEPA if Alternative B is selected as the preferred alternative.

3.8.4.2.5. Alternative C

3.8.4.2.5.1. Construction and Operation of Solar and Storage Facilities

Alternative C would result in construction activities that have the potential to affect federally and state-listed species directly or indirectly. There is also the potential for cumulative effects to federally and state-listed species with the expansion of 10,000 MW of solar facilities as identified in the 2019 IRP. As noted in Table 3.2-1, TVA has evaluated typical effects associated with the development of solar facilities. Forty-eight percent of solar projects studied resulted in

effects to federally listed endangered or threatened species, primarily listed bats as a result of tree clearing. Based on the assumption of thirty 100 MW solar sites, approximately 14 sites would result in effects to federally listed endangered or threatened species. TVA and solar developers would minimize effects to protected species by siting facilities on previously disturbed land, such as agricultural or silvicultural sites, or land with few sensitive wildlife habitats. If forested sites are developed for solar or storage, tree clearing would likely be limited to winter periods when feasible, or presence/absence surveys for protected bats and birds would be conducted. Further, the developers with TVA power purchase agreements would be required to complete Section 7 consultation through TVA and comply with USFWS conservation measures, which would result in the minimization or mitigation of effects.

3.8.4.2.5.2. Transmission and Other Components

Alternative C would result in construction of transmission lines and components that have the potential to affect federally and state-listed species directly or indirectly. There is also the potential for cumulative effects to federally and state-listed species with the expansion of 10,000 MW of solar facilities as identified in the 2019 IRP. Based on a review of 298 transmission line projects from 2005 to 2018, 32 of 256 projects (11 percent) affected federally listed threatened or endangered species or species proposed or Candidates for listing (Table 3.3-1). Of 298 projects reviewed, 63 (22 percent) projects affected state-listed endangered, threatened, or special concern species. Habitat and species surveys would be required for the proposed transmission lines associated with each solar or BESS site. Surveys and USFWS consultation would be required if Alternative C is selected as the preferred alternative.

3.9. Natural Areas, Parks, and Recreation

3.9.1. Affected Environment

Natural Areas, parks and recreation areas include sites typically managed or used for one or more of the objectives of recreation, plant and wildlife protection and management, scientific research and education, and scenic protection. They include national, state, and local parks and recreation areas; trails and greenways; national and state wildlife refuges, wildlife management areas, and forests; research natural areas; and scenic areas. This section addresses the natural areas, parks, or recreation areas that are on, immediately adjacent to (within 1 mile), or within the vicinity of the project areas (5-mile radius).

3.9.1.1. CUF Reservation

The only established recreation site on the CUF Reservation is a boat ramp with a capacity of approximately 15 vehicles/trailers. The ramp is located at RM 102.8. The cooling water discharge attracts boat fishing, and some bank fishing may also occur in this area. The Lower Cumberland River from the Kentucky-Tennessee line (CRM 74.6, approximately 28 miles upstream of CUF) to Cummings Creek (CRM 118.3, approximately 15 miles downstream of CUF) is classified for domestic and industrial water supply use, fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. The entire length of Wells Creek is classified for fish and aquatic life use, recreation, livestock watering and wildlife, and irrigation (TDEC 2019a). No Nationwide Rivers Inventory streams or Wild and Scenic Rivers are located near the CUF Reservation.

In addition, several public and commercial recreation and natural areas are located in the vicinity of the CUF. The Lake Barkley Recreation Area includes several sites, including one adjacent to and within CUF, that are managed by the USACE for camping, hiking, fishing, boating, and hunting. The Cross Creeks National Wildlife Refuge, located just north of the CUF boundary, is managed for biodiversity by the USFWS and is open to the general public on a

seasonal basis. The Barkley Wildlife Management Area is located approximately 0.9 miles east of CUF. It is managed for biodiversity by the TWRA and is open to the general public on a seasonal basis. It is also located near a known meteor impact site, known as the Wells Creek Impact Structure. Recreational areas listed in the U.S. Protected Areas Database (US PAD) within 0.5 mile of the CUF Reservation are illustrated on Figure 3.9-1. The NRHP-listed Henry Hollister House (also known as the Jesse Brunson Place) is located on the CUF Reservation and immediately adjacent to the proposed CC plant. This property includes a ca. 1850 house and historic cemetery and is discussed in more detail in Section 3.13.

Local sites not listed in the US PAD include Riverbend Recreation Area and Guices Creek Recreation Area, which are located approximately 0.2 miles north and 0.9 miles west of the project site, respectively. Recreation areas within five miles of the project areas include Schmidt Family Park, a community park southwest of the project area; Betsy Ligon Park, a community park that offers a playground, basketball court, walking paths, picnic areas, and cultural exhibits located south of the project area; a 1.08 acre conservation easement (Wetlands Reserve Program); and Stewart State Forest.

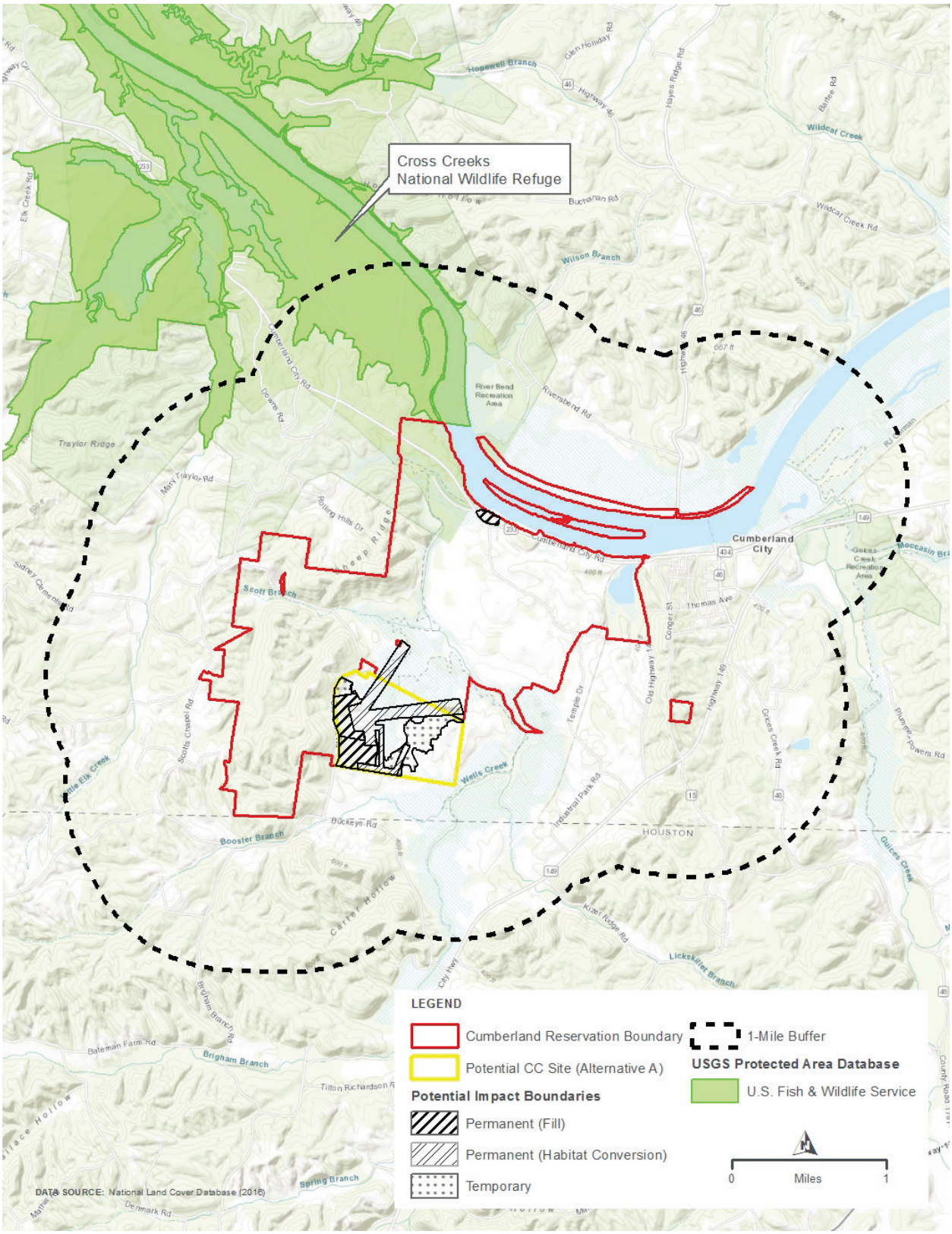

Figure 3.9-1. Federally protected areas within 1 mile of the CUF Reservation

3.9.1.2. Alternative A

Natural areas, parks, and recreation in the vicinity of the proposed CC Plant site, TLs and associated components are the same as those described in Section 3.9.1.1. No significant areas exist within the proposed potential impact boundaries of the CC plant and associated components (Figure 3.9-1).

3.9.1.2.1. Natural Gas Pipeline Corridor

Locations of public lands, recreation areas, and other designated special use areas were determined by reviewing available data sources. As of the date of this report, no public or conservation lands have been identified that would be impacted by the pipeline facilities. In March 2022, TGP consulted with the NRCS, which confirmed that no Conservation Reserve Program property or NRCS-controlled easements would be impacted by the pipeline. Two Nationwide Rivers Inventory river segments (Jones Creek and Yellow Creek) would be crossed by the pipeline (NPS 2021), as described in Section 3.6. These protected river segments would be crossed using horizontal directional drilling (HDD) methodology. No other Nationwide Rivers Inventory river segments are located within 0.25 mile of the Project area. No National Wild and Scenic Rivers segments (Rivers 2020) are crossed or located within 0.25 mile of the Project area.

The corridor is within five-mile radius of the following sites listed on the PAD-US:

- 2.0 mi south of Lake Barkley Recreation Area (USACE)
- 0.7 mi north of Hava-Lakatu Lakes
- 3.0 mi north of Interstate Packaging
- 2.0 mi southwest of Guices Creek Recreation Area (TWRA)
- 3.8 mi east of Stewart State Forest (TN Division of Forestry)
- 2.3 mi southeast of Cross Creeks National Wildlife Refuge (USFWS)
- 4.9 mi north of Montgomery Bell State Park (TDEC)
- 4.2 mi west of Cheatham Wildlife Management Area (TWRA)
- 4.9 mi west of Narrows of the Harpeth State Historical Area
- 4.9 mi west of Harpeth River State Park
- 2.7 mi south of River Bend Recreation Area
- 4.0 mi northeast of Betsy Ligon Park
- 0.3 miles northeast of Christian Farms
- 0.8 miles south of Quail Hollow Farm
- 3.4 mi northeast of Dickson County Memorial Park

Recreational and natural areas within five miles of the project area are illustrated on Figure 3.9-2.

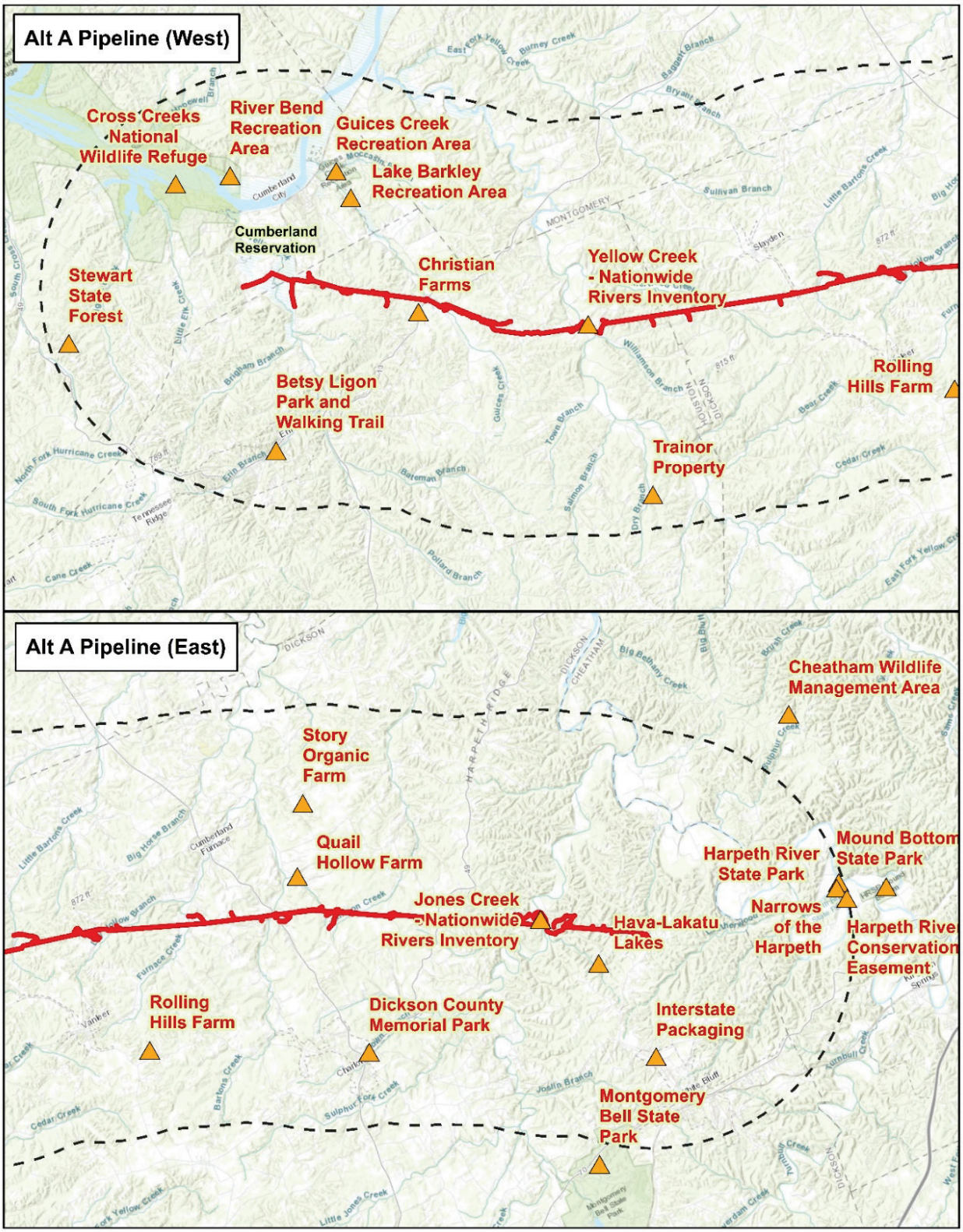

Figure 3.9-2. Natural areas, recreation areas, and parks within 5 miles of the Alt A pipeline

3.9.1.3. Alternative B

3.9.1.3.1. Johnsonville Reservation

JCT is located on the right descending bank of the TVA-managed and US PAD-listed Kentucky Reservoir at TRM 100. Recreation activities in this area of the reservoir and adjacent shoreline include boat fishing, general pleasure boating, swimming, picnicking, camping, and hiking. While there are no boat launching or shoreline fishing facilities on the plant property, plant cooling water discharge attracted boat fishing in the rectangular shaped inlet adjacent to the plant when the plant was operating. Since the plant shut down, boat fishing in this basin has decreased, although some boating activity continues to occur in these waters (TVA 2018a).

In addition to the Kentucky Reservoir, which exists within and in the vicinity of JCT, several additional sites listed on the US PAD exist within the vicinity (Figure 3.9-3):

- 0.9 mi west of Johnsonville State Historic Park (TDEC)
- 0.9 mi east of Camden Wildlife Management Area (TWRA)
- 3.6 mi south of Nathan Bedford Forrest State Park (TDEC)
- 4.7 mi north of Tennessee National Wildlife Refuge (USFWS)

Several public and commercial recreation areas not listed in the US PAD are located in the vicinity of the JCT. Eva Park, a small community park that offers swimming and boat access to Kentucky Reservoir is located approximately 1.6 miles northwest of the CT plant site. C.L. Edwards Memorial Park, a community park that offers ball fields, walking paths, and pavilions is located approximately 0.2 mile south of the project area. The New Johnsonville Boat Ramp is located 0.5 miles southwest of the site and is used for boating and fishing.

Commercial recreation areas within 5 miles of the project areas include Anchor Harbor Marina, New Johnsonville Boat Ramp, Pebble Isle Marina, and Beaver Dam Resort. Anchor Harbor Marina is located within one mile of JCT and is accessed from U.S. Route 70. Pebble Isle Marina and Beaver Dam Resort are located more than one mile from JCT. Additional natural areas within five miles of the JCT include: DCH Slabside Pearly Mussel, DCH Fluted Kidneyshell, and Kentucky Reservoir Mussel Management Study Area; Pilot Knob Potential National Landmark; Tribble Woods Protection Planning Site; Tribble Woods TVA Habitat Protection Area; and a Land Trust for Tennessee Conservation Easement property.

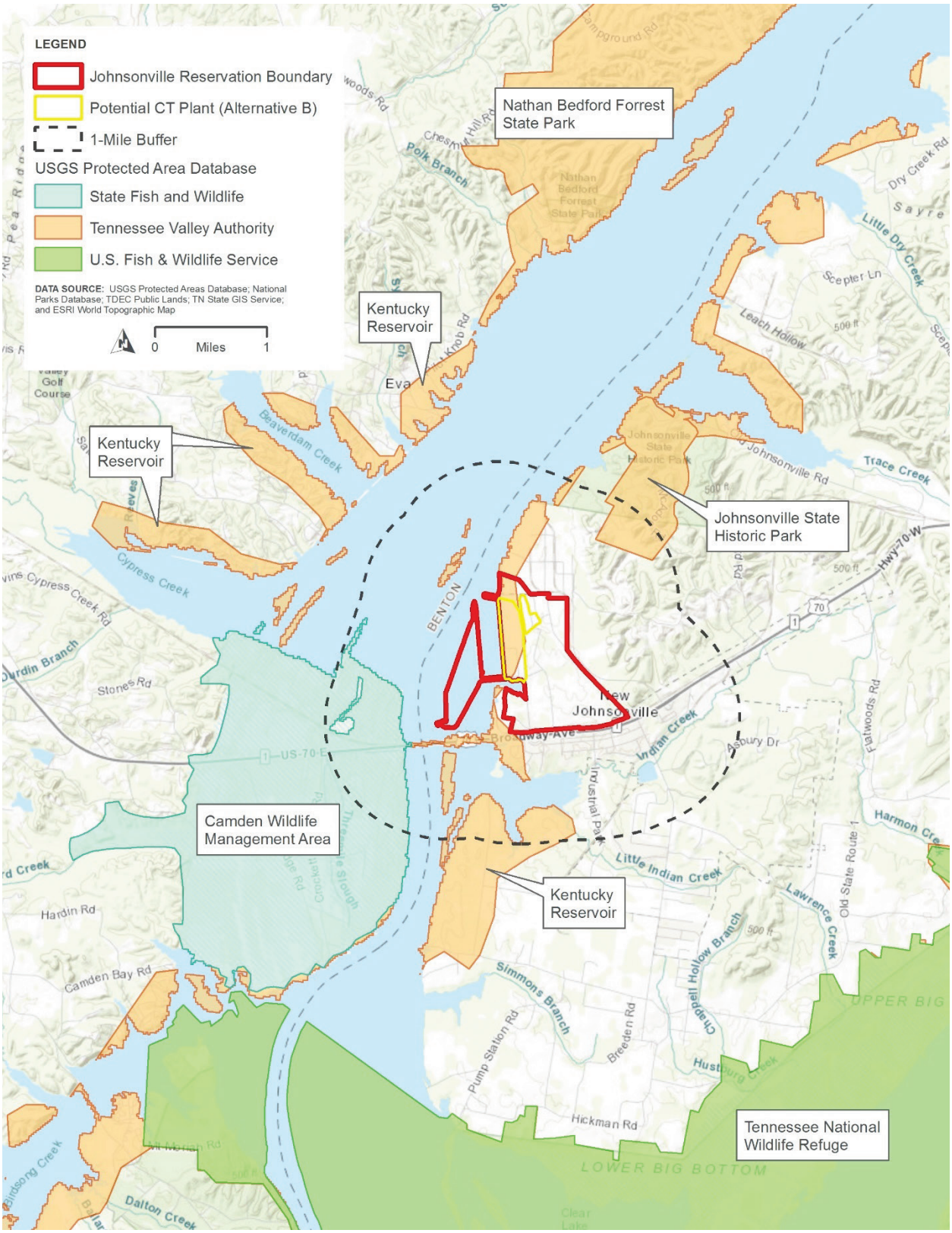

Figure 3.9-3. Federally and state-protected areas within a 1 mile radius of the Johnsonville Reservation

3.9.1.3.2. Gleason Reservation

There are no parks, managed areas, or ecologically significant sites on the Gleason property, and no areas listed in the US PAD exist within a five-mile radius of the site aside from the adjacent Middle Fork Obion River, which is on the National Rivers Inventory. No Wild and Scenic Rivers are within a five-mile radius of the site. No known lease agreements exist for recreational activities onsite. However, several public and commercial recreation areas are located in its vicinity. Gleason Raceway Park, a small raceway track that hosts racing events and car shows is located approximately 1.2 miles west of the project site. Rolling Hills Miniature Golf is located approximately one mile south of the project site. Gleason Community Center and Gleason Baseball Fields are located approximately 1.3 miles south of the project area. Recreational and natural areas within the direct vicinity of the project area (1 mi buffer) are illustrated on Figure 3.9-4.

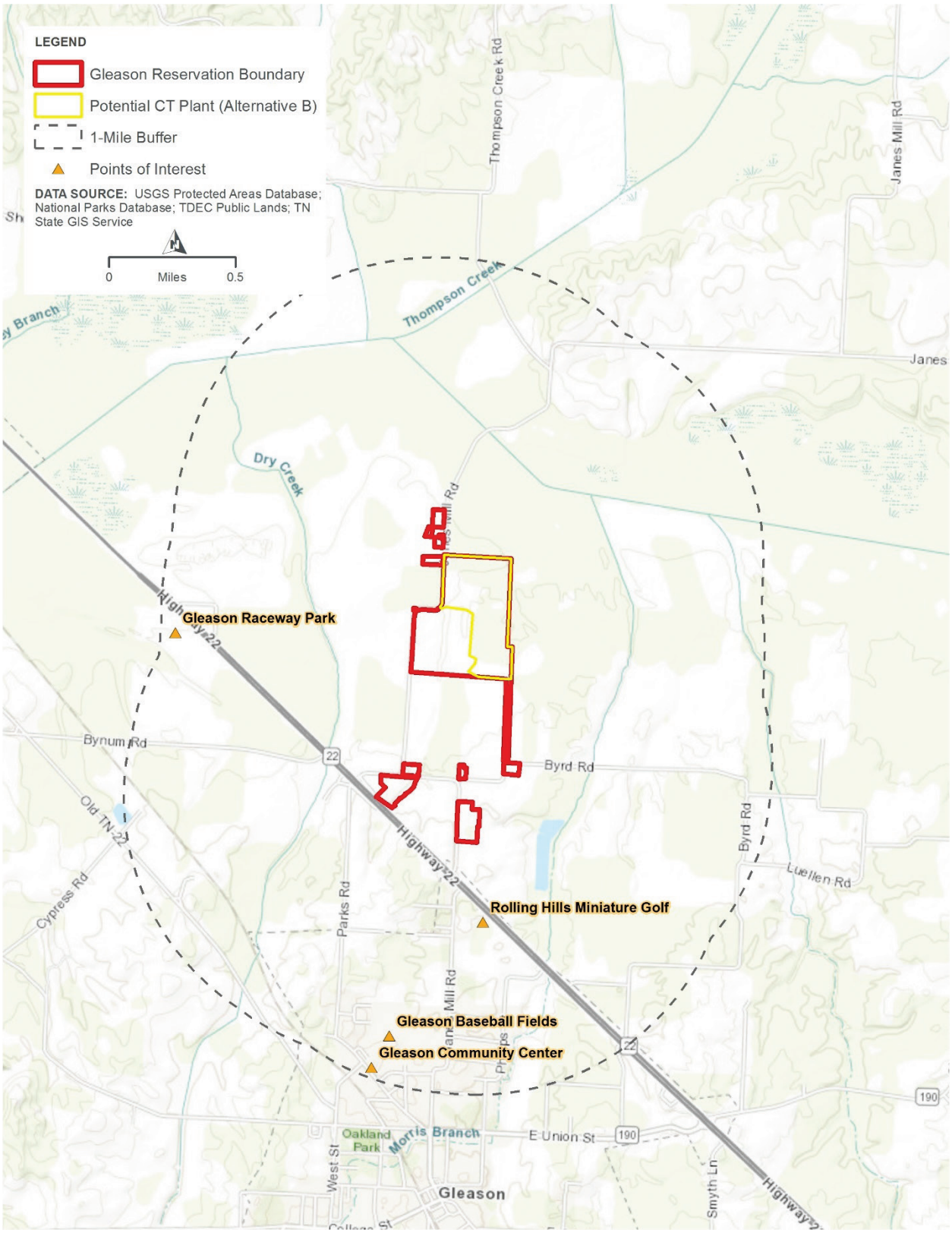

Figure 3.9-4. Natural and recreational areas within a 1-mile radius of Gleason Reservation

3.9.1.3.3. Transmission Corridors

A route has not been identified for the proposed transmission corridor between Martin and Buchanan, Tennessee. According to the US PAD database, the following natural and recreation areas exist within the vicinity of this area: Obion River Wildlife Management Area (TWRA); Bean Switch Refuge (TWRA); Martin Recreation Complex (City of Martin); Harrison Road Complex (City of Martin); and Big Sandy Unit Tennessee National Wildlife Refuge (USFWS). No waterbodies listed in the National Rivers Inventory or Wild and Scenic Rivers exist near the corridor.

3.9.1.4. Alternative C

3.9.1.4.1. Middle Tennessee TVA Power Service Area

TVA anticipates that a portion of the solar facilities proposed under Alternative C would be located in the Middle Tennessee region in order to offset transmission system upgrades that may be required following the retirement of CUF. Numerous parks, managed areas and ecologically significant sites occur throughout the TVA service area in all physiographic regions, but are mostly concentrated outside of Middle Tennessee. Individual ecologically significant areas vary in size from a few acres to thousands of acres. Many areas cross state boundaries or are managed cooperatively by multiple agencies. Waterbodies listed in the National Rivers Inventory include the Harpeth River, Piney River, Green River, Red River, Stones River, Cumberland River, Elk River, Richland Creek, Goose Creek, Smith Fork, Sink Creek, Charles Creek, and Collins River.

Power from these facilities would typically be delivered by direct connection to TVA's transmission system or via interconnections with local power companies that distribute power from TVA. TVA transmission line rights-of-way cross eleven NPS units, nine National Forests, six National Wildlife Refuges, and numerous state wildlife management areas, state parks, and local parks (TVA 2018c). As specific sites have not yet been determined for evaluation under this alternative, typical effects of transmission projects have been listed under Table 3.3-1.

3.9.2. Environmental Consequences

3.9.2.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to maintain and operate the CUF plant. TVA would implement all of the planned actions related to the current and future management and storage of CCRs. There would be no project-related effects to natural areas, parks and recreation areas in the vicinity of CUF. Dispersed recreation use patterns, especially bank fishing, would likely continue on some portions of the CUF.

3.9.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Under all action alternatives, TVA would retire, decommission, deactivate, decontaminate, and deconstruct the CUF units and site. Because there are substantial distances between developed natural areas, parks and recreation areas in the vicinity of the site and the CUF boundaries, no effects on these areas are anticipated. The retirement, decommissioning, deactivation, decontamination, and deconstruction of the CUF plant may temporarily eliminate or reduce fishing and other dispersed recreational activities on the CUF site and in the Cumberland River. However, it is expected that these dispersed recreation activities could be accommodated at other similar banks in the surrounding area. Therefore, project effects on dispersed outdoor recreational activities should be minor. In addition, public access to the boat launching ramp located within the CUF boundary could be temporarily interrupted during

deconstruction activities, resulting in minor adverse effects to boating launching opportunities. No cumulative effects to natural areas, parks, or recreation would occur.

3.9.2.2.1. Environmental Justice Considerations

If fishing on the CUF Reservation is temporarily limited or not allowed, this could in turn adversely affect EJ populations and other populations that currently fish and hunt at the Lake Barkley Recreation, portions of which are onsite on the CUF Reservation (USACE 2022a). These effects may be amplified on EJ populations due to the likelihood that the reliance on these recreational resources is more critical to or are long-term cultural practices of these low-income and minority populations.

3.9.2.3. Alternative A

3.9.2.3.1. Construction and Operation of CC Plant at Plant Site

Under Alternative A, TVA would retire the CUF, demolish the units, and construct and operate a CC plant and its associated transmission lines on the CUF Reservation. Improvements to the barge unloading area (Figure 2.1-3) are also associated with Alternative A. The existing barge unloading area would continue to serve as a public boat ramp after construction is complete. Improvements may include the replacement of the existing concrete surfacing, widening, and an extension of the nose. The improvements would be made largely for public enjoyment, as TVA would only utilize the unloading area on scheduled delivery days. During construction, the boat ramp within the CUF would be temporarily closed to the public to accommodate barge unloading activities. While temporary closure of the ramp will reduce boat access to waters around the plant site, Guices Creek Ramp, located about 2 miles upstream from CUF, will continue to provide access to this general part of the Cumberland River. Therefore, adverse effects to boating launching activities will be temporary and minor during construction but beneficial and long-term after construction is complete. No additional effects on natural areas, parks, and recreation areas in the project vicinity are anticipated outside of the CC Plant site.

No cumulative effects to natural areas, parks, or recreation are expected to occur, as any effects would be localized and minimal and recreational users could utilize other nearby facilities.

3.9.2.3.2. Construction and Operation of Natural Gas Pipeline

No direct effects to parks or managed areas within the 800-acre proposed pipeline corridor would occur. The pipeline crossing of Yellow Creek and Jones Creek, both on the National Rivers Inventory, would be constructed by the HDD technique with minimal disturbance to the stream banks and streambed. HDD requires the use of large quantities of drilling muds that have the risk of creating inadvertent returns which have the potential to impact water quality and aquatic life. However, TGP anticipates that no impacts to protected river segments would occur from the proposed Project due to the implementation of BMPs and mitigation measures (TGP 2022h). See Section 3.6.2.2.3.2 for a description of BMPs and mitigation measures that would be implemented to minimize these impacts. No direct, long-term effects to the other resources would occur within a five-mile radius. The only effects anticipated are minor and temporary effects to traffic on roads surrounding the sites during construction as well as temporary noise and visual disturbances during construction. Cumulative effects related to construction could occur as a result of past/present and RFFAs in proximity to the proposed pipeline.

3.9.2.3.3. Summary of Alternative A

In sum, improvements to the barge unloading area are associated with Alternative A. The only negative impacts anticipated are minor and temporary effects to traffic on roads surrounding the sites during construction as well as temporary noise and visual disturbances during

construction. No additional effects on natural areas, parks, and recreation areas in the Project vicinity are anticipated outside of the CC Plant site or pipeline corridor.

3.9.2.3.4. Environmental Justice Considerations

If fishing on the CUF Reservation is temporarily limited or not allowed, this could in turn adversely affect EJ populations and other populations that currently fish and hunt at the Lake Barkley Recreation, portions of which are onsite on the CUF Reservation (USACE 2022a). These effects have the potential to be amplified on EJ populations due to the likelihood that the reliance on these recreational resources is more critical to or are long-term cultural practices of these low-income and minority populations. Long term benefits will occur due to the improvement of the public boat ramp as a part of Alternative A.

3.9.2.4. Alternative B

3.9.2.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Under Alternative B, TVA would retire the CUF, demolish the units, and construct a CT plant on property located within the boundaries of the JCT Reservation. Long-term effects are not likely to occur to recreational activities within the Kentucky Reservoir as the CT plant construction would not affect as the recreational activities within and near the Reservoir. Noise and increased traffic during construction may have slight short-term effects on nearby areas identified in Section 3.9.1.3.1; however, the resources will still be accessible throughout construction. Therefore, project effects on dispersed outdoor recreational activities as well as natural resources should be minor. No cumulative effects to natural or recreation areas are expected to occur.

3.9.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

Under Alternative B, TVA would retire the CUF, demolish the units, and construct a new CT plant on a portion of the Gleason Reservation. Because there are substantial distances between developed recreation areas and the site, no effects on these recreation areas are anticipated. There are no dispersed recreational activities such as hunting that are known to occur on the site. No other environmentally significant areas were identified in proximity to the reservation. Therefore, project effects on dispersed outdoor recreational activities should be minor to nonexistent. Because no recreational activities are known to occur on or near the site, no cumulative effects to natural or recreation areas are expected to occur.

3.9.2.4.3. Transmission and Other Components

The proposed 40-mile-long TL would be sited to avoid and minimize effects to multiple parks, managed areas, and ecologically significant sites between Martin and Buchanan, Tennessee. There could be some short-term disruption of informal recreational use, such as hunting, within and immediately adjacent to the TL route during construction. No cumulative effects to natural or recreation areas are expected to occur, as siting is planned to avoid recreational areas and no known projects are anticipated to occur in the areas that would disrupt recreational activities.

3.9.2.4.4. Environmental Justice Considerations

If long-term effects occur to recreational activities within the Kentucky Reservoir, which is partially within the boundaries of the proposed CT plant, this could in turn adversely affect EJ populations and other populations that currently utilize the recreation area. These effects have the potential to be amplified on EJ populations due to the likelihood that the reliance on these recreational resources is more critical to or are long-term cultural practices of these low-income and minority populations.

3.9.2.5. Alternative C

3.9.2.5.1. Construction and Operation of Solar and Storage Facilities

Because the exact project locations for solar and storage projects are not known at this time, TVA has compiled a list of typical effects associated with the construction and operation of PV facilities within the TVA region. This list was compiled by reviewing the EAs and EISs for PV projects, ranging from community scale to utility scale, over the past several years, 2014 through 2021. Based on the review of 31 projects, it was found that only 6.5 percent of solar projects affected parks and public lands. Based on the assumption of thirty 100 MW solar sites, approximately 2 sites would result in effects to parks and public lands.

Individual facilities would be sited to avoid effects to natural areas, parks, and other developed recreation areas and designed to reduce any visual effects to nearby areas. Solar and storage facilities would eliminate informal recreational uses such as hunting from the 21,900 acres proposed to be developed. The land area required for battery storage facilities is typically only a few acres and construction-related effects are minimal. Operational effects are also minimal with adherence to typical mitigation measures and best management practices.

Future projects in the geographic area of analysis that include use of undeveloped lands to support industrial or other intensive developments could reduce the availability of lands suitable for recreation. In addition to the 3,000 MW of solar facilities, TVA is proposing to add 10,000 MW of solar by 2035 to meet customer demands and system needs. This would decrease the amount of potentially available land to support dispersed outdoor recreation activities such as, hunting, fishing, or nature observation. The combined effect of these future land development actions and Alternative C would likely result in a reduction in resources for dispersed recreation. However, in view of the relatively large amounts of rural and undeveloped lands within the Middle Tennessee, as well as the larger TVA region, cumulative effects on dispersed recreation opportunities are expected to be minor. Because developed outdoor recreation areas are largely located sufficiently distant from the solar or storage project sites, no more than minor direct, indirect or cumulative effects on these resources are expected.

3.9.2.5.2. Transmission and Other Components

New TL connections, substations, etc. would typically be on or immediately adjacent to the solar/storage facility site, and they would be planned to minimize adverse effects to natural areas, parks, and recreation areas. New TLs would eliminate forested areas within the corridor, which could have long-term effects on ecological significance and recreational activities in the area.

A review of past solar PPA projects reflected an average of approximately 17.7 acres of long-term effects as a result of access roads, transmission interconnections and upgrades for each solar facility. Based on the assumption of thirty 100 MW solar sites, approximately 531 acres would be affected. Upgrades are typically performed to increase the electrical capacity of the existing transmission lines and would include the items listed in Section 2.1.3.2.2.

In the 2019 IRP EIS, TVA compiled a list of typical effects from construction activities related to transmission projects. A total of 298 projects were included in the review (Table 3.3-1). It was found that 16 percent of 249 projects affected parks and public lands. There is the potential for cumulative effects with additional transmission lines and upgrades associated with an additional 10,000 MW of solar facilities by 2035. Cumulative effects would be minimized through siting and routing of transmission lines to avoid natural and recreation areas.

3.10. Land Use

3.10.1. Regulatory Framework

Use of Federal and state lands are generally regulated by the acts establishing the various agencies as well as other laws. For example, the TVA Act gives TVA the authority to regulate the use of lands it manages as well as development across, along, or in the Tennessee River or any of its tributaries. The Farmland Protection Policy Act of 1981 (7 U.S.C. 4201 et seq.) recognizes the importance of prime farmland. Various state laws and local ordinances regulate land use, although a large portion of land in the TVA region is not subject to local zoning ordinances (TVA 2019b).

3.10.2. Affected Environment

3.10.2.1. CUF Reservation

Land use is defined as the way people use and develop land, including leaving land undeveloped and using land for agricultural, residential, commercial, and industrial purposes. Much of the construction under Alternative A would be on the CUF reservation. This site offers the advantages of being a previously disturbed area within existing TVA property; having existing transmission interconnection to the TVA transmission system; and being 30 miles from a major interstate natural gas pipeline lateral. Stewart County does not have a land use plan for the unincorporated portions of the county nor are lands subject to zoning restrictions (Stewart County Mayor's Office; personal communication; September 24, 2021).

Images generated with the NLCD evaluation, visualization, and analysis tool show the CUF Reservation as largely deciduous forest with smaller areas of pasture and open water (Figure 3.10-1). The 2021 field investigations revealed a larger percentage of wetlands on the CUF site and within the boundaries of the proposed CC plant site than what is depicted on desktop NLCD results (TVA 2021e). See Section 3.6 for more information on field survey findings.

Table 3.10-1. Land Cover Within the CUF Reservation (Source: NLCD 2019)

ALT A – CUF RESERVATION		
	Area (Acres)	% of Total Land
Barren Land	100.75	4.21%
Cultivated Crops	132.50	5.55%
Deciduous Forest	23.27	0.97%
Developed, High Intensity	965.08	40.42%
Developed, Low Intensity	82.33	3.45%
Developed, Medium Intensity	97.72	4.09%
Developed, Open Space	113.56	4.76%
Emergent Herbaceous Wetlands	81.54	3.42%
Evergreen Forest	31.50	1.32%
Hay/Pasture	4.36	0.18%
Herbaceous	339.71	14.23%
Mixed Forest	14.51	0.61%
Open Water	75.89	3.18%
Shrub/Scrub	313.28	13.12%
Woody Wetlands	11.61	0.49%
Total	**2387.61**	**100.0%**

The 2,388-acre CUF Reservation consists of flat to gently rolling terrain that ranges in elevation from approximately 355 to 658 feet above mean sea level. Topography is highest on the western portion of the reservation, decreasing in elevation towards the northeast (Figure 3.6-2). CUF is located at the confluence of Wells Creek and the south bank of the Cumberland River, and Cumberland City Road (TN 233) runs along the northern border of the reservation. Rolling Hills Drive intersects the reservation and Old Scott Road intersects the CC plant site in the western portions. The reservation is bordered by Buckeye Road to the southwest. The reservation is bordered by Old Highway 149 and intersected by Wickham Avenue in the northeastern portion (Figure 3.10-1).

Forested and agricultural land makes up a majority of the land surrounding the reservation with smaller pockets of residential/commercial areas. Several industrial facilities are present alongside Old Highway 149 and Temple Drive southeast of the reservation. Small pockets of residences are present along Scotts Chapel Road west of the reservation. The fossil plant is within the corporate limits of Cumberland City, a town with a population of 305 (USCB 2020), and the remainder of the reservation is in unincorporated Stewart County. The next closest municipality is the City of Erin, which contains 1,224 residents and is 3.4 miles south of the reservation (USCB 2020).

Available historical aerial photographs and USGS topographic quadrangles document that land use near the project area was beginning to be developed dating back to the first available map in 1931, which showed the existence of many of the same major roadways and corridors as can be seen today. The addition of a quarry and the CUF site significantly changed the Project Site in the late 1960s and early 1970s. Industrial development has continued since the coal plant was completed in the 1960s as TVA expanded CCR storage areas and other industrial development, some associated with TVA (e.g., the wallboard plant), mostly to the east and southeast of the reservation.

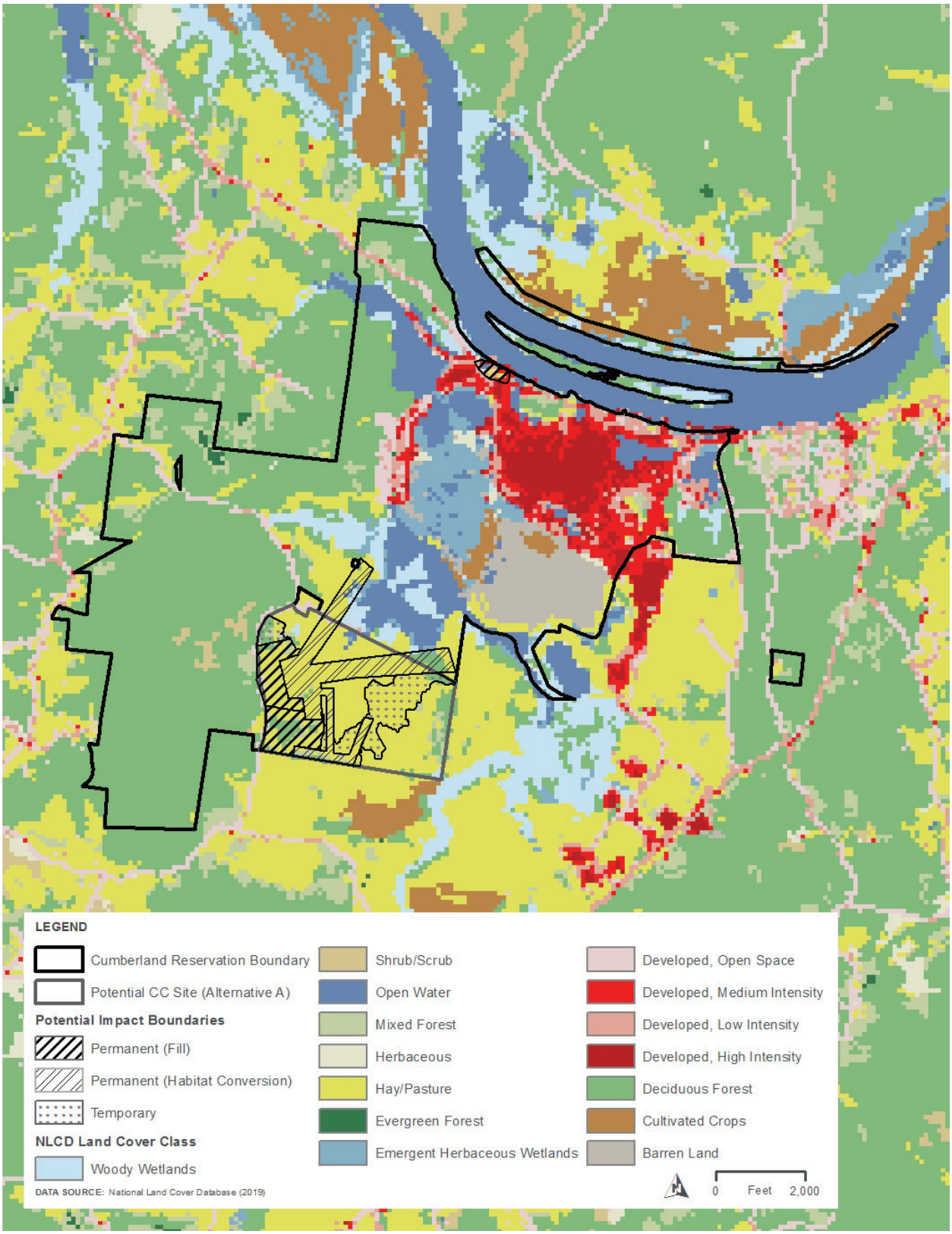

Figure 3.10-1. Land Cover Within and Adjacent to the Proposed Alternative A CC Plant and CUF Reservation (Source: NLCD 2019)

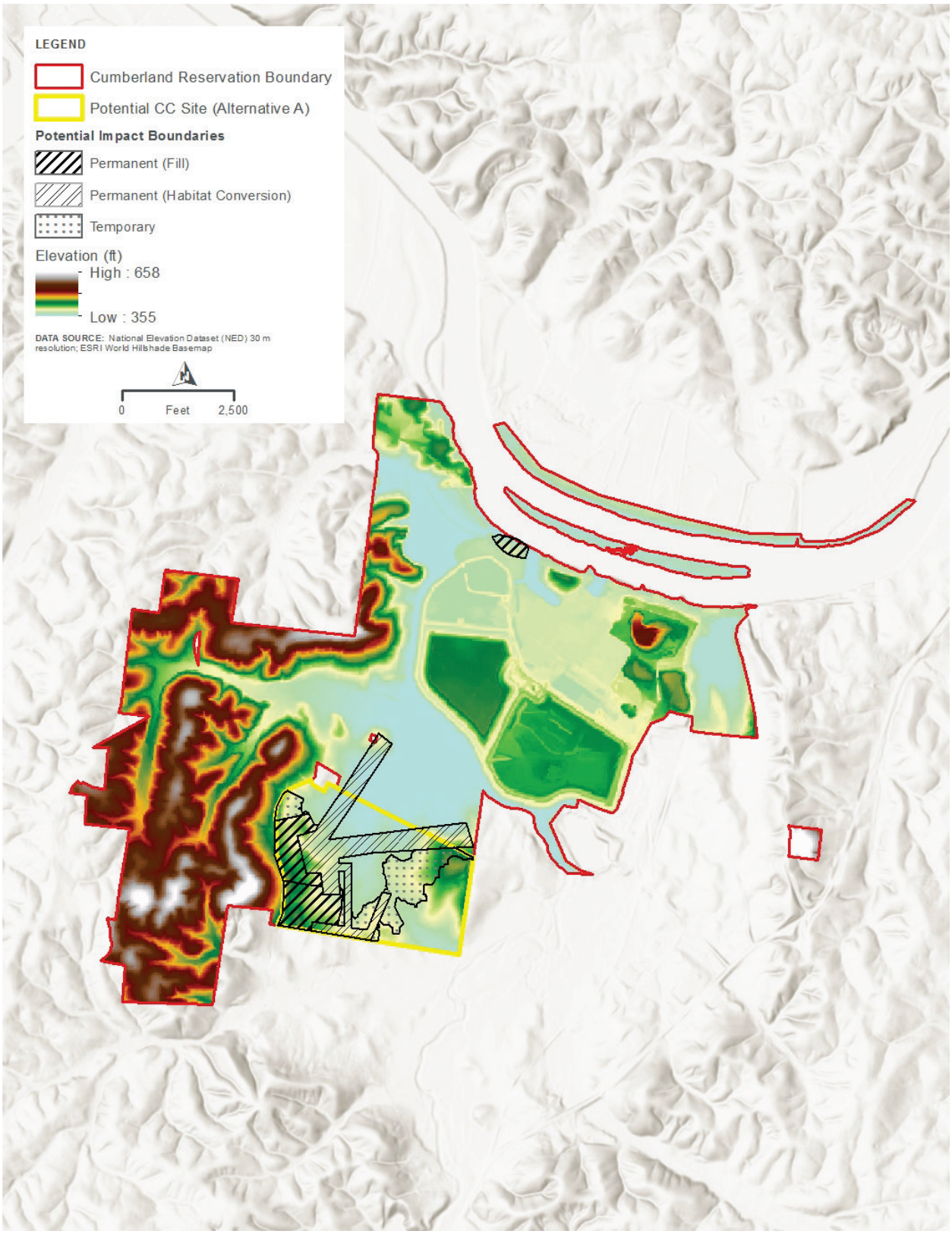

Figure 3.10-2. Elevation within the Alternative A proposed CC plant location and the CUF Reservation

3.10.2.2. Alternative A

3.10.2.2.1. Proposed CC Plant

Land use within the proposed CC plant site, TLs and associated components would be within the CUF Reservation as described in Section 3.10.2.1. Current land use in the area is largely industrial and agricultural.

Although the area has had intense disturbance as a result of plant operations, the proposed CC plant site is a greenfield site composed of fields, woodlands, and wetlands and has been farmed in the past. The Tennessee Trustee classifies the project area, including the Project Site, as commercial, agricultural, and farmland (Tennessee Trustee 2020 Stewart County Property Tax Information). Images generated with the NLCD evaluation, visualization, and analysis tool show the original CC plant boundaries (Option A2) and the revised impact area as largely hay and pasture with small areas of forest (Figure 3.10-1)

Table 3.10-2. Land Cover Within and Adjacent to the Original Alternative A CC Plant and TL Upgrades Boundary (Option A2) (Source: NLCD 2019)

ALT A – OPTION A2 CC SITE		
NLCD Land Cover Type	Area (Acres)	% of Total Land
Open Water	1.56	0.56%
Developed, Open Space	5.56	1.99%
Deciduous Forest	20.91	7.49%
Mixed Forest	22.91	8.21%
Hay/Pasture	227.06	81.35%
Woody Wetlands	0.89	0.32%
Emergent Herbaceous Wetlands	0.22	0.08%
Total	**279.10**	**100.0%**

Table 3.10-3. Land Cover Within and Adjacent to the Revised Potential Impact Boundaries (Source: NLCD 2019)

ALT A - REVISED POTENTIAL IMPACT BOUNDARIES		
NLCD Land Cover Type	Area (Acres)	% of Total Land
Deciduous Forest	17.51	8.85%
Developed, Low Intensity	1.92	0.97%
Developed, Medium Intensity	1.68	0.85%
Developed, Open Space	7.49	3.79%
Emergent Herbaceous Wetlands	1.48	0.75%
Hay/Pasture	149.34	75.45%
Mixed Forest	16.58	8.38%
Open Water	1.03	0.52%
Woody Wetlands	0.89	0.45%
Total	**197.92**	**100.0%**

The revised potential impact boundaries have the highest elevation near the CC plant at approximately 500 feet above mean sea level, which slopes towards the northeast to 355 feet above mean sea level where the TL upgrades would occur (Figure 3.10-2)

3.10.2.2.2. Natural Gas Pipeline Corridor

The proposed corridor for the natural gas pipeline that would provide fuel for the CC plant is shown on Figure 2.1-3 and is generally parallel to an existing TVA 500-kV TL. Land within the proposed 800-acre corridor is largely deciduous forest and pastureland (Table 3.10-4, Figure 3.10-3).

Table 3.10-4. Land Cover Within and Adjacent to the Proposed Alternative A Natural Gas Pipeline Corridor (Source: NLCD 2019)

Land Cover Types	Area (acres)	% of Total Area
Open Water	0.22	0.02%
Developed, Open Space	56.27	5.01%
Developed, Low Intensity	3.78	0.34%
Deciduous Forest	624.26	55.55%
Evergreen Forest	4.23	0.38%
Mixed Forest	65.38	5.82%
Shrub/Scrub	6.00	0.53%
Herbaceous	10.90	0.97%
Hay/Pasture	308.02	27.41%
Cultivated Crops	40.03	3.56%
Woody Wetlands	2.45	0.22%
Emergent Herbaceous Wetlands	2.22	0.20%
Total	**1,123.76**	**100.0%**

As stated in TGP's Resource Report 8 (TGP 2022h):

> Land use in the pipeline corridor were classified and defined based on Multi-Resolution Land Characteristics Consortium ("MRLC") National Land Cover Database (MRLC 2019) and field observations completed over the majority of the pipeline route and locations of aboveground pipeline facilities, contractor yards, and access roads. Land use was identified based on review of recent aerial photographs along portions of the pipeline route for which survey access has not been granted. Six major land use categories were defined, as described below.
>
> **Agricultural Land**
> Cultivated Crops - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton. Crop vegetation accounts for greater than 20 percent of total vegetation of the land use category. This category also includes land being actively tilled.
>
> Hay/Pasture - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation of the land use category.
>
> **Developed Land**
> Developed Land – Industrial, commercial, and residential areas. Includes manufacturing or industrial plants, paved areas, natural gas utility aboveground facilities, roads, commercial or retail facilities, and other developed areas.

Upland Forests

Deciduous Forest - Areas dominated by trees generally more than 5 meters tall, accounting for more than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.

Evergreen Forest - Areas dominated by trees generally more than 5 meters tall, accounting for more than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

Mixed Forest - Areas dominated by trees generally greater than five meters tall and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.

Open Land

Open Space - Open land communities include open space and shrub-scrub areas such as heavily-maintained roadway and transmission line corridors, as well as fallow fields and pasture land. The level of maintenance varies and actively determines the species composition in these communities.

Shrub-Scrub - Areas dominated by shrubs less than five meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage, and trees stunted due to environmental conditions.

Right-of-Way (ROW) – Existing linear ROWs, including roadways, overhead power transmission lines, and major and minor linear utilities.

Open Water

Open Water - Ephemeral, intermittent, and perennial waterbodies and ponds.

Wetlands

Emergent Wetland - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Woody Wetland - Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

The corridor crosses Highway 149, Highway 13, Highway 235, Highway 49, and terminates at Highway 250. Forested and rural-residential land uses dominate the landscape surrounding the corridor. Several businesses and residential concentrations are present alongside and occasionally within the corridor, especially in areas where the corridor intersects major roadways. The closest municipalities moving from west to southeast are Cumberland City, the town of Slayden, the town of Vanleer, the unincorporated community of Cumberland Furnace, the town of Charlotte, and the unincorporated community of Greenwood.

The corridor consists of terrain that ranges in elevation from approximately 355 to 871 feet above mean sea level. Topography is lowest at the western-most origin point of the pipeline at CUF, encountering a series of plateaus and valleys along the length of the pipeline. The highest points occur in the middle of the corridor, between figure slides #2 and #3 (Figure 3.10-4).

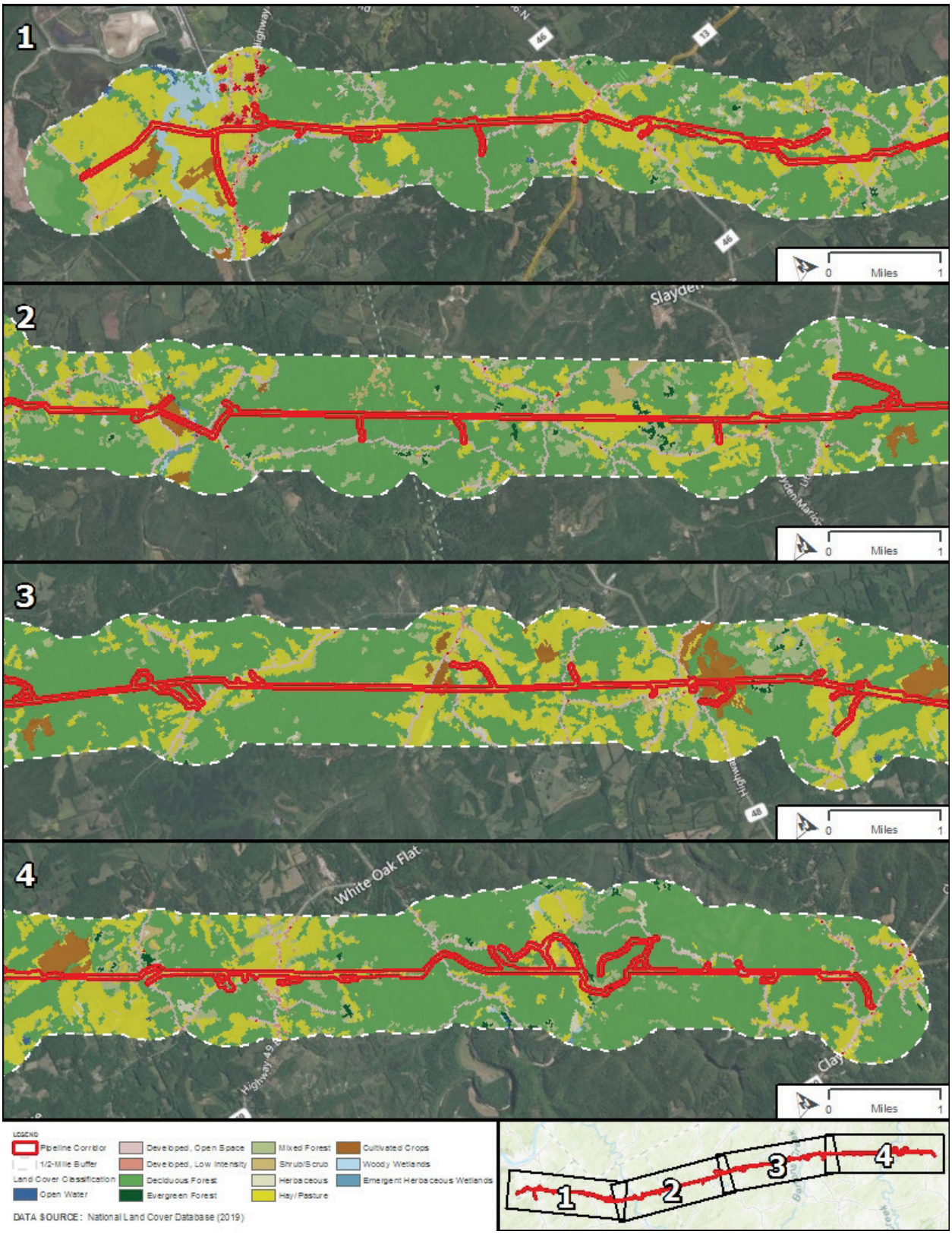

Figure 3.10-3. Land cover within and adjacent to the proposed Alternative A natural gas pipeline corridor (Source: NLCD 2019)

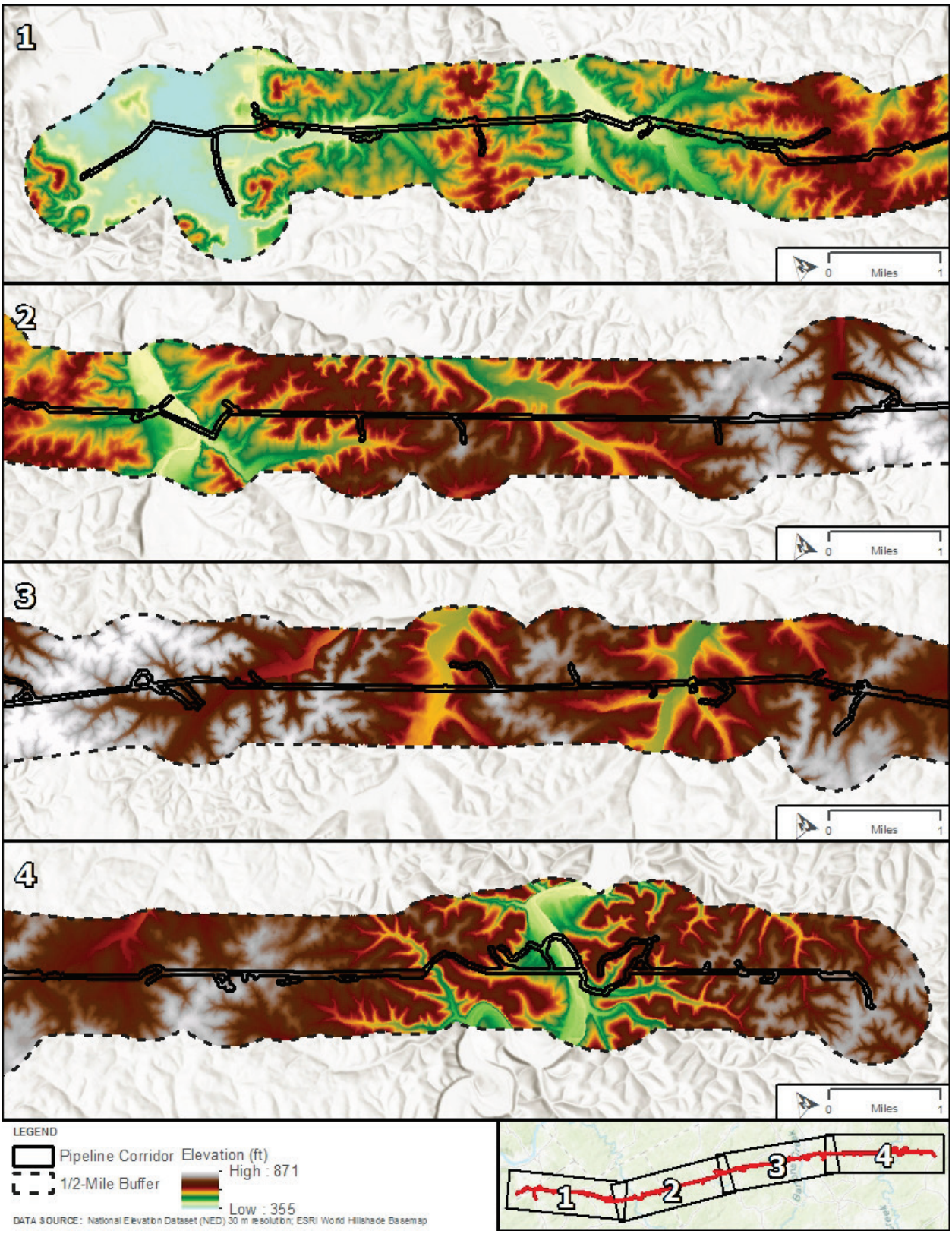

Figure 3.10-4. Elevation within the Alternative A proposed natural gas pipeline corridor

3.10.2.3. Alternative B

3.10.2.3.1. Johnsonville Reservation

The JCT is located near New Johnsonville in Humphreys County, Tennessee. The reservation is approximately 720 mostly developed acres and located on the east bank of the Kentucky Reservoir of the Tennessee River. The reservation once hosted 10 coal-fired units, which have all been retired and are being demolished, and currently hosts 20 active CT units, one of which supplies co-generation steam to an adjacent chemical plant. An ash pond remains in the eastern portion of the site from the retired coal-fired units. State of Tennessee Comptroller of the Treasury's Real Estate Assessment Data classifies the area, including the JCT, as residential, commercial, industrial, and Federal land (State of Tennessee 2021). Humphreys County does not have land use plans or zoning regulations for unincorporated areas of the county; however, the City of New Johnsonville has zoning regulations within the city limits as well as within a five-mile buffer surrounding the city limits (Humphreys County Executive's Office; personal communication; September 24, 2021). JCT is zoned as industrial (I-1) (City of New Johnsonville, Richie Blue; personal communication; September 24, 2021). No relevant land use plan exists for the site.

Images generated with the NLCD evaluation, visualization, and analysis tool show JCT as consisting primarily of developed medium/high intensity area and hay/pasture, and the CT plant location consists of medium/high intensity area and open water (Figure 3.10-5). The full breakdown of land use types within the JCT can be seen in Table 3.10-5.

The elevation within the proposed CT plant site is largely uniform with low relief, ranging from 355 to 407 feet above mean sea level (Figure 3.10-6). The site is bordered on the south, east, and north by industrial facilities and on the west by an excavated harbor area.

Table 3.10-5. Land cover within JCT Reservation (Source: NLCD 2019).

Land Cover Types	Area (acres)	% of Total Area
Open Water	21.79	20.55%
Developed, Open Space	0.44	0.42%
Developed, Low Intensity	6.45	6.08%
Developed, Medium Intensity	29.36	27.67%
Developed, High Intensity	39.81	37.53%
Barren Land	6.89	6.50%
Herbaceous	0.22	0.21%
Emergent Herbaceous Wetlands	1.11	1.05%
Total	**106.08**	**100.0%**

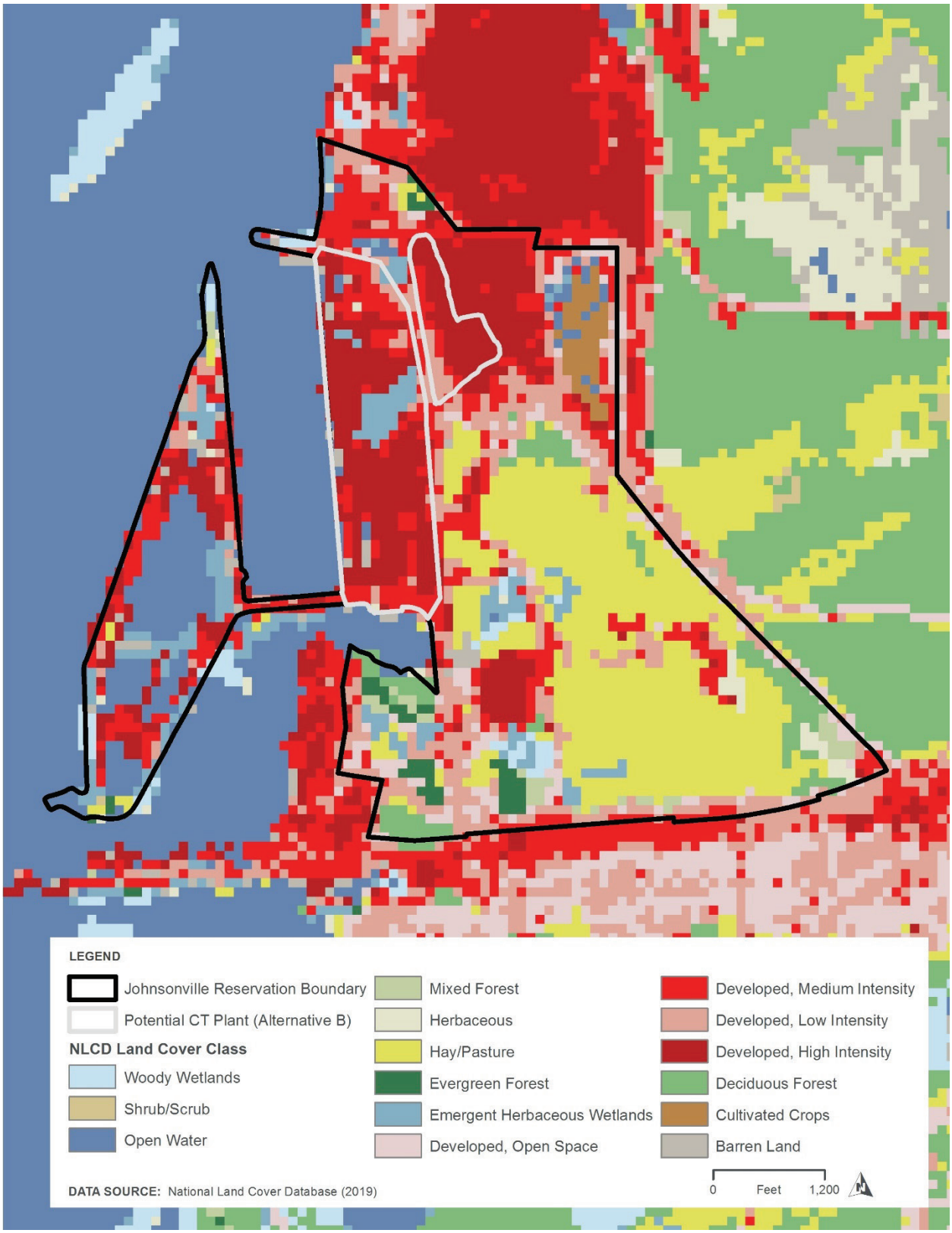

Figure 3.10-5. Land cover within the proposed Alternative B CT plant location within the Johnsonville Reservation (Source: NLCD 2019)

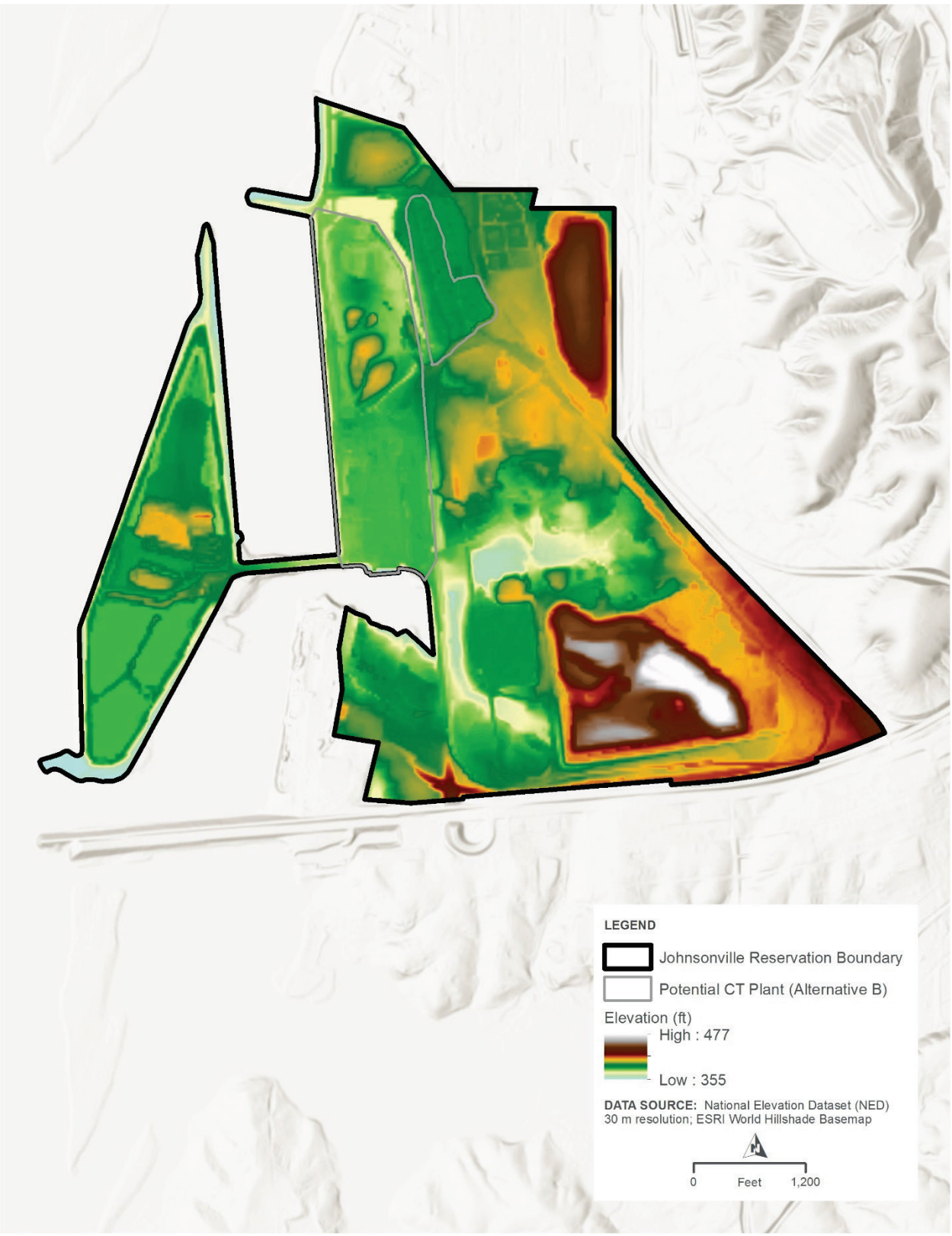

Figure 3.10-6. Elevation within the Alternative B proposed CT plant location within the Johnsonville Reservation

U.S. Route 70/ State Highway 1, also locally known as Broadway Avenue, runs east to west near the southern border of JCT, and North Street runs north to south along JCT's eastern border. The surrounding area is largely forested and industrial/commercial with residential concentrations south of JCT. Several businesses are present alongside Broadway Avenue. JCT is within the corporate limits of New Johnsonville that has a population of 1,804, and the next closest municipality is the unincorporated community of Eva with a population of 293 (USCB 2020).

Available historical aerial photographs and USGS topographic quadrangles document that land use in and around JCT was largely rural aside from structures neighboring the CSX railway running parallel to Broadway Ave. Over time, land use became much more industrialized with the construction of JCT beginning in 1949.

3.10.2.3.2. Gleason Reservation

The Gleason reservation is located near Dresden in Weakley County, Tennessee. The reservation is approximately 97 acres and currently hosts a three-unit CT plant with a combined generation capacity of 500 MW. Unlike JCT, the proposed CT plant site is largely greenfield. The Weakley County Trustee classifies the project area, including the CT plant site, as public utility (Weakley County Trustee; personal communication; September 24, 2021). Weakley County does not have a land use plan for the unincorporated portions of the county nor are lands subject to zoning restrictions (Weakley County Trustee; personal communication; September 24, 2021).

Images generated with the NLCD evaluation, visualization, and analysis tool show the proposed CT plant location as primarily cultivated crops and woody wetlands (Figure 3.10-7). Land use types within the proposed CT plant location can be seen in Table 3.10-6. The potential CT plant location is largely uniform with low relief, ranging from 349 to 371 feet above mean sea level (Figure 3.10-8). Topography is highest on the southern portion of the boundary, decreasing to the northeast.

The reservation is bordered by Janes Mill Road to the west. Agricultural and rural-residential land uses dominate the landscape south, west, and east of the reservation while undeveloped, forested land is north and northeast of the reservation. Several businesses are present alongside TN-22 southwest of the reservation, and development increases towards the south moving closer to the town of Gleason, the closest municipality with a population of approximately 1,369 (USCB 2020). Small residential concentrations are present within and just outside of the town limits.

Available historical aerial photographs and USGS topographic quadrangles document that land use in the project area has stayed largely rural-residential and agricultural with development staying relatively constrained to the Gleason town limits since the first available map from 1956.

Table 3.10-6. Land cover within the proposed Alternative B CT plant location within the Gleason Reservation (Source: NLCD 2019).

NLCD Land Use	Area (acres)	% of Total Land
Developed, Open Space	0.22	0.36%
Developed, Low Intensity	2.22	3.57%
Mixed Forest	0.67	1.07%
Cultivated Crops	38.70	62.14%
Woody Wetlands	20.46	32.86%
Totals	**62.27**	**100.0%**

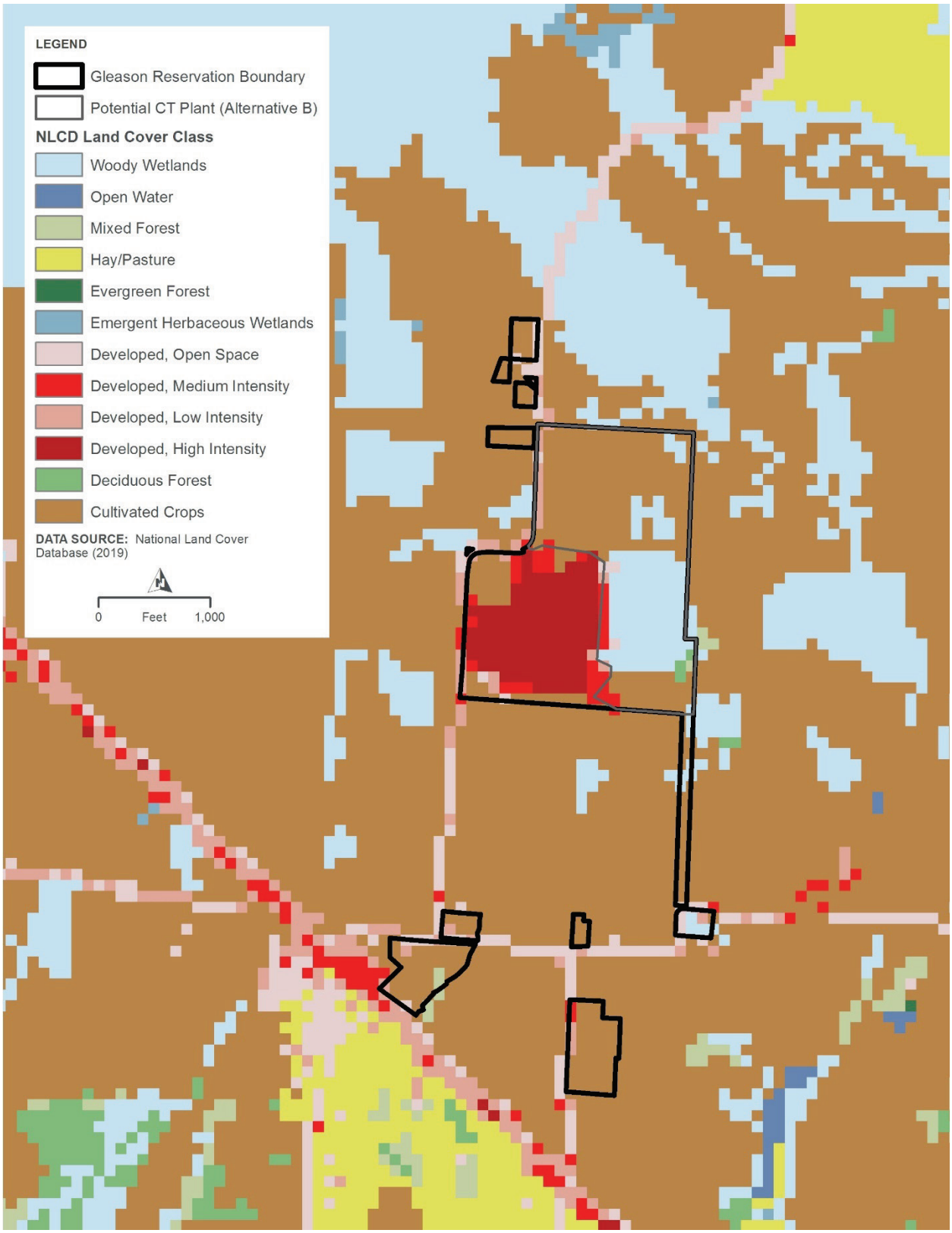

Figure 3.10-7. Land cover within the proposed Alternative B CT plant location within the Gleason Reservation (Source: NLCD 2019).

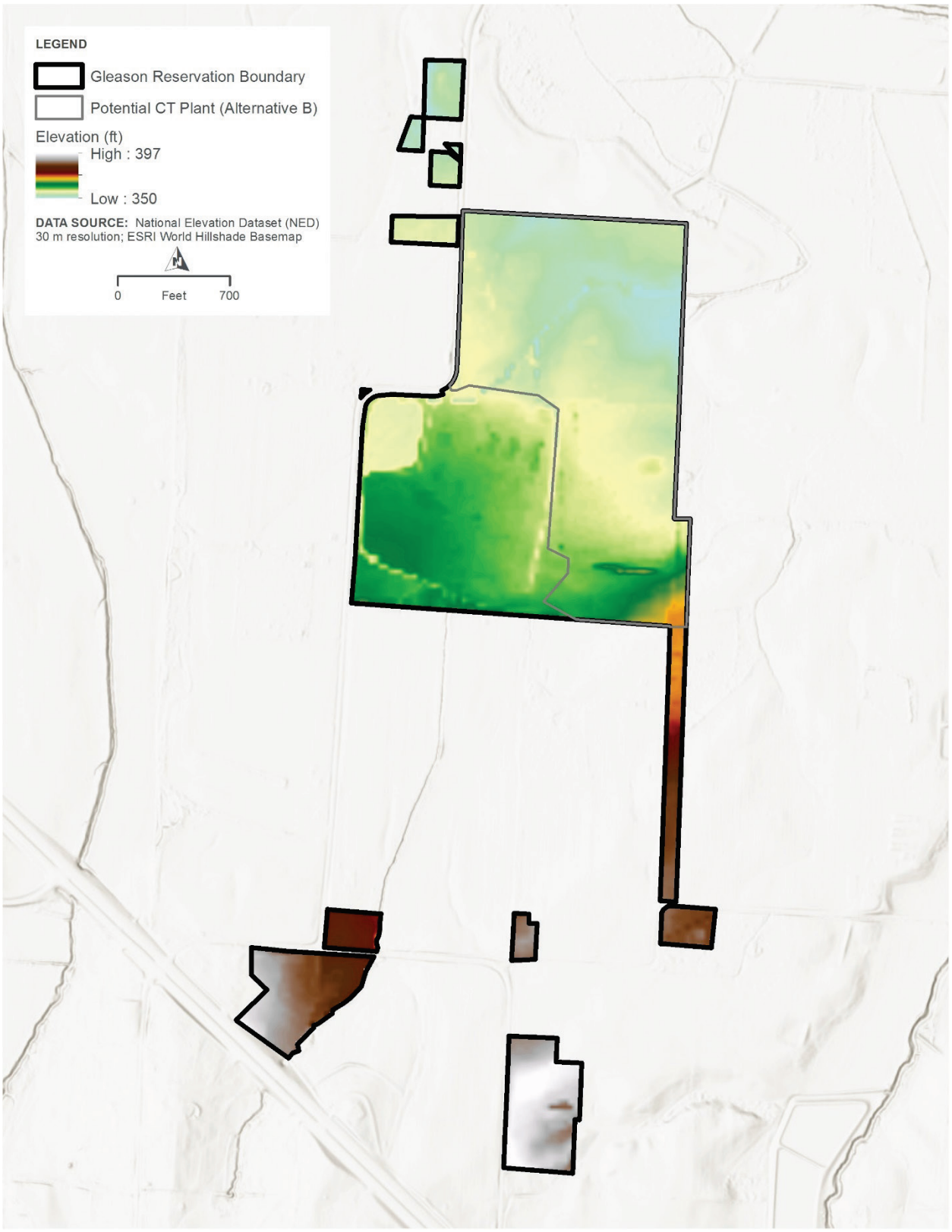

Figure 3.10-8. Elevation within the proposed Alternative B CT plant location within the Gleason Reservation

3.10.2.3.3. Transmission Corridors

Under Alternative B, TVA would construct a new approximately 40-mile 500-kV TL from the Weakley 500-kV station to a new station on the Marshall-Cumberland 500-kV TL. Land use along the proposed route is largely agricultural with smaller areas of forest. The proposed TL line intersects small, developed areas, including seven main roadways and multiple smaller rural roads.

3.10.2.4. Alternative C

3.10.2.4.1. Middle Tennessee TVA Power Service Area

TVA anticipates that a portion of the solar facilities proposed under Alternative C will need to be physically located in the Middle Tennessee region in order to offset transmission system upgrades that may be required following the retirement of CUF.

Middle Tennessee encompasses about 41% of the total land area in Tennessee, located mostly within the Nashville Basin, a dome, and the Highland Rim. The Cumberland Plateau is known for its hardwood forests and is one of the top hardwood timber producers in the country (Honey 2019). Forestland is predicted to decrease between 1997 and 2060 in the majority of counties in the TVA region, with several counties in the vicinity of Memphis, Nashville, Huntsville, Chattanooga, Knoxville and the Tri-Cities area of Tennessee predicted to lose more than 25 percent of forest area (Wear and Greis 2013). Loss of forest area within the TVA region is primarily a result of increasing urbanization and development. Most of the TVA region in some rural parts of western Tennessee are predicted to show little change, or in some scenarios, small increases in forestland by 2060 (Wear and Greis 2013).

Agriculture is a major land use and industry in the TVA region. In 2012, 41 percent of the land area in the TVA region was farmland that comprised 151,000 individual farms (USDA 2014). Between 2012 and 2017, statewide data for Tennessee show a small increase in the number of farms (USDA 2019c). The number of small farms (between 1 and 9 acres) in Tennessee has increased between 2012 and 2017, following a national trend (USDA 2019c). Average farm sizes range between 155 and 326 acres for states within the TVA region and have generally increased in size between 1997 and 2017. Middle Tennessee farms typically grow soybeans and tobacco, as well as raising beef cattle.

For the state of Tennessee, cropland and pastureland comprise 17 and 16 percent, respectively, of rural, non-Federal land in 2017 (USDA 2018b). Both cropland and pastureland have decreased in area since 1982; however, the rate of cropland and pastureland loss in Tennessee has declined between 2012 and 2015 (USDA 2018b). Farms in the TVA region produce a large variety of products that vary across the region. Region-wide, the major crop items by land area are forage crops (hay and crops grown for silage), soy, corn and cotton. The major farm commodities by sales are cattle and calves, poultry and eggs, grains and beans, cotton and nursery products (USDA 2014). Between 2012 and 2017, statewide data for Tennessee shows decreases in the number of farms and acres producing short rotation woody crops (USDA 2019c).

Power from these facilities would typically be delivered by direct connection to TVA's transmission system or via interconnections with local power companies that distribute power from TVA. As specific sites have not yet been determined for evaluation under this alternative, typical effects of solar and transmission projects have been listed under Sections 3.2 and 3.3.

3.10.3. Environmental Consequences

3.10.3.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to maintain and operate the CUF plant and would implement all of the planned actions related to the current and future management and storage of CCRs. Existing land uses in the areas of the action alternatives would likely remain industrial and rural.

3.10.3.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Under all action alternatives, TVA would retire, decommission, deactivate, decontaminate, and deconstruct the CUF units and site. Land uses within the 2,388-acre CUF Reservation would remain industrial regardless of the action alternative selected to replace its generation, as an intake pump station, booster fan building, diesel fire pump house, switchyards, wastewater treatment system, and other facilities would remain operational onsite. As the land would remain in TVA possession and would not be accessible by the public, aside from the boat ramp which will be improved for public use, this change in land use would be considered insignificant. All previously approved CCR projects would continue to be implemented. Deconstruction of all aboveground structures within the project site to a depth of 3 ft below grade would result in disturbance to the soil in the immediate vicinity of the structures. All structures with below grade features would be filled with material from the deconstruction process as well as imported fill. This would result in a net increase in the amount of soil available on the site. As the entire project site is a previously disturbed area and would continue to be designated for nonagricultural purposes, no effects to prime farmland are anticipated. Once the D4 activities are completed, there is the potential for land use changes if the coal plant site is redeveloped. Cumulative effects to land use would not occur associated with the CCR management activities on the CUF Reservation.

3.10.3.3. Alternative A

3.10.3.3.1. Construction and Operation of CC Plant at CUF

Under Alternative A, TVA would construct and operate a CC plant and TL upgrades within a 196-acre portion of the CUF Reservation. TLs would be constructed resulting in minor effects to land use. Land use on the developed portions of the CC plant site would change from the current, largely hay/pasture to industrial and the rest of the site would remain largely undeveloped. Depending on access needs, existing access roads may require modifications such as brush clearing or tree trimming to allow for passage of equipment and bucket trucks, which will impose short-term effects during construction. Minimal ground disturbance is expected in laydown areas and in the boundaries of access roads, but, if the ground is disturbed, the area would be revegetated using native, low-growing plant species after required TL upgrade work is completed. Long-term effects to land use would occur due to the conversion of any forest along the TL route to fields.

The activities associated with Alternative A would not have any indirect effects on land use, as further changes to the rural area would not be expected to be stimulated by the CC plant. The Project could continue the current land's industrial use for at least 30 years. Upon completion of CC plant decommissioning, the land could continue to be used for power generation or for other industrial uses. No cumulative effects to land use would occur.

3.10.3.3.2. Construction and Operation of Natural Gas Pipeline

Table 3.10-7 quantifies the acreage of land cover types that would be affected by construction of the pipeline. The largest change in land cover would be the reduction in forest and the

resulting increase in open land. The overall land requirements for the pipeline facilities include a typical 100-foot-wide construction ROW and a new 50-foot-wide permanent ROW, which would be required for safe operation and maintenance of the pipeline. The construction ROW for the pipeline would overlap with or abut, in certain areas, an existing cleared transmission line ROW. The permanent ROW for the pipeline would abut or parallel the existing transmission line ROW (TGP 2022h).

Table 3.10-7. Land Use Affected by Construction and Operation of the Pipeline (in acres)

Facilities	Agriculture		Developed[3]		Forest		Open Land		Open Water		Wetlands		Total	
	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation
Pipeline ROW[4]	38.76	38.4	4.1	3.97	116.25	123.41	24.28	24.46	0.53	1.05	0.11	0.05	184.03	191.34
ATWS	17.21		5.11		31.15		10.37		0.24				64.08	0
Subtotal for Pipeline	55.97	38.4	9.21	3.97	147.4	123.41	34.65	24.46	0.77	1.05	0.11	0.05	248.11	191.34
Pressure Regulation Station[5]				0.13		1.04							0	1.17
Contractor Yard							31.43						31.43	0
Access Roads[6]	7.41		2.28	0.01	19.03	0.12	5.77		0.04		0.01		34.54	0.13
Cumberland Meter Station[7]		0.29				0.57							0	0.86
Grand Total	**63.38**	**38.69**	**11.49**	**4.11**	**166.43**	**125.14**	**71.85**	**24.46**	**0.81**	**1.05**	**0.12**	**0.05**	**314.08**	**193.50**

[1] The numbers in this table have been rounded for presentation purposes. As a result, the totals may not reflect the sum of the addends in all cases.
[2] Construction and operation impacts are based on planned temporary workspaces and permanent workspaces, respectively.
[3] The Developed land use category includes approximately 1.54 acres of residential land that will be affected by construction and operation of the Project.
[4] Area for the MLV and the PAR to the MLV are included in the land requirements for the Cumberland Pipeline new permanent ROW.
[5] Area for a pig launcher/receiver and area for the PAR for the pressure regulation station is included in the land requirements for the pressure regulation station.
[6] Area for a pig launcher/receiver and area for the PAR for the Cumberland meter station is included in the land requirements for the Cumberland meter station.
[7] Temporary workspace for the Cumberland meter station is included in the land requirements for ATWS for construction of the pipeline.

ATWS areas include additional workspace beyond the permanent ROW and temporary construction ROW that are typically related to special construction techniques, such as road bores and wetland and waterbody crossings, equipment staging along the ROW, construction consumables storage (such as matting), pipeline points of intersection, fenceline crossings, and at locations where additional volumes of spoil will be generated.

An MLV is planned for development at an intermediate location along the Cumberland Pipeline. The MLV will be accessed by a new PAR. Land requirements for the MLV and associated PAR are included in the land requirements for the pipeline. Approximately 248 acres would be utilized for construction workspace, including the MLV at MP 16.6 and associated PAR and TAR. Of these 248 acres, 184 acres are for the construction workspace including the MLV, and 62 acres are for the ATWS.

Upon completion of construction, 191.34 acres would be maintained as permanent ROW. To ensure operational safety and to allow for routine operation and maintenance of the Project facilities, no trees or structures would be allowed within the permanent ROW. Land used as construction workspace and ATWS would revert to pre-construction condition.

Following construction, TGP would generally maintain a 50-foot wide permanent easement. Within that easement, landowners may use the easement area to the extent it does not interfere with the pipeline facilities. Within this permanent easement, landowners would be prohibited from planting trees; constructing houses, buildings, roads, dams, levees, lakes, reservoirs, ponds, structures, fixtures or any similar or dissimilar obstructions, without written permission from TGP. Within the permanent easement, the landowner would have the right to mow. Following construction, the temporary easement would be allowed to revert to its original conditions. In the temporary easement, landowners would have no restrictions after construction.

The pressure regulation station would be situated on a 1.17-acre parcel in Dickson County. A new PAR would be constructed to access the pressure regulation station during construction and operation of the facility. TGP proposes to install two new MLVs, one on each of the existing TGP 100-3 and 100-4 pipelines, and a pig launcher/receiver within the pressure regulation station at MP 0. It is assumed that the full 1.17 acres of land disturbance for the pressure regulation station, including the associated PAR, MLVs, and pig launcher/receiver, would be permanent.

Two approximate 16-acre contractor yards (Contractor Yard 1 and Contractor Yard 2), located in Houston County and Dickson County, respectively, have been identified for use during Project construction. The yards would be multi-purpose sites used during construction of the Project for contractor trailers, equipment storage, fabrication, and as pipe yards. Following construction, Contractor Yard 1 and Contractor Yard 2 would be restored in accordance with the FERC *Upland Erosion Control, Revegetation, and Maintenance Plan* (May 2013 version) ("FERC Plan"); therefore, the Project-related land disturbance at both contractor yards would be temporary.

Activities at the Project contractor yards would generally take place from 7:00 am to 7:00 pm each day, six days per week. Activities at and uses of the contractor yards include safe areas for construction personnel to gather/meet, bulk fuel/lubricant storage, heavy equipment storage and maintenance, pipe fabrication, construction personnel parking, expendables staging, and TGP/contractor management trailers. One of the contractor yards would also be used for mainline pipe staging. Noise-emitting activities that would occur at contractor yards include pipe

fabrication, heavy equipment movement, personal vehicle movement, and general handling of pipeline ancillary equipment. Light-emitting activities include safety lighting at night for security. TGP anticipates that a majority of contractor yard activities would occur at the beginning and end of each work day, as construction personnel enter and leave the contractor yards. Throughout each work day, deliveries of materials and equipment are anticipated to be made at each contractor yard. Members of the public using the public access roads that TGP proposes to use to access the contractor yards would mainly be impacted at the beginning and end of each work day when construction personnel enter and leave the contractor yards. The construction contractor would implement traffic control at each contractor yard to ensure that impacts to the public would be minimized. Several NSAs are located within 0.25 mile of both contractor yards.

3.10.3.3.3. Summary of Alternative A

In sum, approximately 703 acres of land would be impacted as a result of Alternative A. Approximately 147 acres would be permanent fill or permanent habitat conversion on the CUF Reservation due to CC Plant construction and barge unloading upgrades, and approximately 48 acres would be temporary workspace that would be revegetated following construction. Land use on the developed portions of the CC plant site would change from the current, largely hay/ pasture to industrial and the rest of the site would remain largely undeveloped. A total of approximately 314 acres of land would be temporarily impacted as a result of pipeline construction, and 193 acres would be permanently affected due to conversion to maintained open space. To ensure operational safety and to allow for routine operation and maintenance of the Project facilities, no trees or structures would be allowed within the permanent ROW. Land used as construction workspace and ATWS would revert to pre-construction condition.

3.10.3.3.4. Environmental Justice Considerations

Long-term land conversion effects associated with the pipeline corridor could in turn adversely affect EJ populations and non-EJ populations. As the majority of the corridor falls within EJ areas, these effects have the potential to be amplified on EJ populations.

3.10.3.4. Alternative B

3.10.3.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Under Alternative B, TVA would retire the CUF, demolish the units, and construct a total of four CT units on the Johnsonville Reservation. The completed CT plant would occupy less than 10 acres of the 100-acre, brownfield CT plant site. An additional 33 acres of the CT plant site would be used for laydown and parking during construction. Following construction, this area would be revegetated. The CT plant construction and operation would not change the industrial land use of the plant site or affect the industrial use of adjacent lands.

The activities associated with Alternative B would not have any indirect effects on land use, as further changes to the rural area would not be expected to be stimulated by the CT plant. No cumulative effects to land use would occur.

3.10.3.4.2. Construction and Operation of CT Plant at Gleason Reservation

Under Alternative B, TVA would retire the CUF, demolish the units, and construct a new CT plant on the Gleason reservation. The CT plants would occupy less than 10 undeveloped acres of the 97-acre site. Land uses within the CT Plant site would be converted from cropland to industrial use, and the 60 acres identified for laydown or parking areas would be allowed to revert to their original use after construction.

The activities associated with Alternative B would not have any indirect effects on land use, as further changes to the rural area would not be expected to be stimulated by the CT plant. No cumulative effects to land use would occur.

3.10.3.4.3. Transmission and Other Components

Depending on access needs, existing access roads may require modifications such as brush clearing or tree trimming to allow for passage of equipment and bucket trucks, which would impose short-term effects during construction. Minimal ground disturbance is expected in these areas, but if the ground is disturbed, the access road area would be revegetated using native, low-growing plant species after required TL upgrade work is completed. Areas such as pasture, agricultural fields, or lawns would be returned to their former condition following construction. Long-term effects to land use would occur due to the conversion of any forest along the TL route to fields.

Table 3.3-1 lists typical effects from TVA transmission construction projects. An average of 13.1 acres were used per TL mile, and an average of 10.8 acres were used for new substations and switching stations. TLs averaged 0 acres of floodplain fill, 0 acres of prime farmland converted, and 5.5 acres of forest cleared per line mile. Substations and switching stations averaged 0.1 acres of floodplain fill, 6.9 acres of prime farmland converted, and 4.5 acres of forest cleared per station constructed. For the 40-mile TL, it can be estimated that 220 acres of forest would be cleared, resulting in a long-term effect to forest management.

3.10.3.5. Alternative C

3.10.3.5.1. Construction and Operation of Solar and Storage Facilities

Solar projects require large land acreage (7.3 acres per MW, Table 3.2-1). Under Alternative C, TVA would construct and operate 3,000 MW of solar and 1,700 MW of battery storage at various sites, mostly within Middle Tennessee, which would require about 21,900 acres for the solar facilities and 640 acres for the battery storage facilities. Land use effects would be spread across multiple sites. Based on the assumption of thirty 100 MW solar sites, each site would affect approximately 730 acres of land.

Most operating and planned and approved TVA utility-scale solar facilities have been constructed on previously cleared pasture, hayfield, or crop land, and most have required little grading to smooth or level the site. Almost all TVA solar projects have affected farmland (Table 3.2-1) and resulted in changing the land use of farmed portions of the facility sites from agricultural to industrial. Effects to farmland, particularly areas designated as prime farmland, are described in more detail in Section 3.5.1. Forested portions of the sites were also changed to industrial land use. Other land uses on or in the vicinity of the solar facilities have generally not been affected. Land use is a factor in solar and storage site selection process, and some communities in the TVA region have ordinances addressing solar facilities. Some of these facilities require screening to reduce visual/land use effects. The land area required for battery storage facilities is typically only a few acres and construction-related effects are minimal.

Future projects in the geographic area of analysis that include use of undeveloped lands to support industrial or other intensive developments could result in a change in land use. In addition to the 3,000 MW of solar facilities, TVA is proposing to add 10,000 MW of solar by 2035 to meet customer demands and system needs. This would also change undeveloped or agricultural sites to industrial land use. The combined effect of these future land development actions and Alternative C would likely result in cumulative effects in land use changes. However, in view of the relatively large amounts of rural and undeveloped lands within the counties selected, cumulative effects on land use are expected to be moderate.

3.10.3.5.2. Transmission and Other Components

New TL connections and substations would typically be on or immediately adjacent to the solar or storage facilities, and they would be planned to minimize adverse land use effects. New TLs would eliminate forest management land use within the maintained ROW but not agricultural land use. New substations and switching stations would result in conversion to industrial land use. Cumulative effects to land use would also occur from additional transmission lines and substations associated with the addition of 10,000 MW of solar by 2035.

3.11. Transportation

3.11.1. Affected Environment

3.11.1.1. CUF Reservation

CUF is served by highway, railway, and waterway modes of transportation. The closest airport is the Houston County Airport, 15 miles southwest of the site. Cumberland City Road (Highway 233) is the primary arterial roadway serving the CUF site (Figure 2.1-3). The two-lane road is oriented east—west and extends from its intersection with Highway 49 on the east side of Cumberland City to its intersection with Highway 49 to the west of CUF. There are three points of access into CUF from Cumberland City Road. Existing traffic conditions generated by CUF is composed of a mix of cars and light duty trucks, as well as medium duty to heavy duty trucks. The proposed CC plant site may be accessed by Old Scott Road on its western border; however, no traffic data is available from TDOT for this road. Old Scott Road intersects with Scotts Chapel Road, serving as the nearest traffic data point. The 2020-21 Annual Average Daily Traffic (AADT) counts for key roadways near CUF, all of which are 2-lane, are presented in Table 3.11-1.

Table 3.11-1. Average Daily Traffic Volume (2020-21) on Major Roadways Near CUF

Location (Station Number)	Existing AADT
Cumberland City Rd, on the northern border of CUF (81000059)	3,561
SR-46/Grices Creek Rd, 1.2 mi east of CUF (81000063)	781
Highway 149, 0.8 mi SE of CUF (81000073)	4,941
Highway 149, 0.4 mi east of CUF (81000058)	1,834
Scotts Chapel Road, 1.2 miles west of the CC plant site (81000060)	355

Source: Tennessee Department of Transportation, 2020-21[23]

3.11.1.2. Alternative A

3.11.1.2.1. Natural Gas Pipeline Corridor

Under Alternative A, TGP would construct approximately 32 miles of new 30-inch-diameter natural gas pipeline and associated gas system infrastructure originating from TGP's existing 100 Line in Dickson County and terminating at the proposed power plant in Stewart County (TGP 2022e). The pipeline corridor overview map is shown on Figure 2.1-6. The corridor is served by highway and railway modes of transportation. The closest airport is the Schmid Airport, 0.4 miles south of the corridor. The corridor crosses Highway 149, Highway 13, Highway 235, and Highway 49, and terminates at Highway 250. All of these highways are 2-lane. TGP would use existing public and private access roads, as well as new access roads, to enter the construction work areas. All existing access roads are either dirt, gravel, or rock. Most of these existing access roads are being used by TVA for operation and maintenance of the adjacent powerline and associated ROW.

[23] Transportation Data Management System (ms2soft.com)

The 2020-21 AADT counts are presented in Table 3.11-2.

Table 3.11-2. Average Daily Traffic Volume (2020-21) on Roadways Intersected by Alternative A Pipeline

Location (Station Number)	Existing AADT
Highway 149, 0.9 mi NE of the pipeline corridor at its western origin point (81000073)	4,941
TN-13, 2.3 mi NE of the western portion of the corridor (63000045)	603
Highway 235, 1 mi south of the midway point of the corridor (22000019)	1,275
Highway 49, 7.8 mi NE of corridor near the eastern termination point 24 (22000008)	3,358
Highway 250, 3.3 mi NE of eastern termination point of corridor (11000031)	1,140

Source: Tennessee Department of Transportation 2020-21

Three new access roads are currently proposed for permanent use during operation of the Project facilities. New photosynthetically active radiation sensors (PARs) would be necessary at the new Cumberland meter station, pressure regulation station, and the MLV at MP 16.6. TGP intends to follow the Work Zone/Temporary Traffic Control procedures provided on Tennessee Department of Transportation's website (TDOT 2022) during construction and restoration efforts. According to TGP (2022e), an average of 20 roundtrips per day is anticipated for trucks delivering equipment and materials, and another approximately 100-150 vehicles per day are anticipated for commuting construction workers. TGP anticipates approximately 12 months of construction with activities occurring six days per week (Monday-Saturday) (TGP 2022e).

Access to Contractor Yard 1 would be from 46 (Cumberland City Highway) to Guices Creek Road into the south-eastern portion of the parcel. The contractor yard Highway 46 is classified as a major collector (TDOT 2018a). TDOT estimated that an average of 661 (TDOT 2022b) vehicle trips per day travelled on Highway 46 near Contractor Yard 1. Access to Contractor Yard 2 would be from two entry points along Highway 49, one near the eastern end of the yard and the other near the western end of the yard. Highway 49 is classified as a minor arterial (TDOT 2018b). TDOT estimated that an average of 857 vehicle trips per day travelled on Highway 49 near Contractor Yard 2 (TDOT 2022c).

TGP states in Resource Report 5 (TGP 2022e):

> Traffic entering and exiting the contractor yards would be variable over the construction period and throughout each day. Daily traffic would generally be the highest between 6:00 a.m. and 8:00 a.m. as workers arrive to park at the contractor yards and depart to locations along the construction area. The highest traffic would occur during the peak of construction and is estimated to be approximately 100 to 150 vehicles per hour between 6:00 a.m. and 8:00 a.m. After 8:00 a.m., traffic entering and exiting the contractor yards would proceed at a much lower volume throughout the day until approximately 6:00 p.m. Parking for daily commuters would be provided at the contractor yards. TGP anticipates that approximately 40 percent of construction workers would be bussed or would carpool from the contractor yards to the work areas where parking would occur within construction workspaces. Parking at the pressure regulation station, Cumberland meter station,

[24] This AADT location was selected due to the fact that it is the closest traffic marker on this particular roadway, which is intersected by the pipeline corridor, despite the marker being distant from the corridor.

and other aboveground facilities would be designated within the construction workspace, allowing for accessible ingress and egress. Bussing would help reduce impacts on the roadways and the need for parking at the [construction] sites.

Access to the pressure regulation station would be from Highway 250 (Claylick Road) to Pack Road. Highway 250 is classified as a major collector (TDOT 2018b) and Pack Road is classified as a local route (TDOT 2018b). The TDOT estimated that an average of 3,307 vehicle trips per day travelled on Highway 250 near the pressure regulation station (TDOT 2022c). Most local routes including Pack Road do not have traffic count stations (TDOT 2022c).

Access to the Cumberland meter station would be from Old Scott Road from the west. Old Scott Road is classified as a local route (TDOT 2022d). Most local routes including Old Scott Road do not have traffic count stations (TDOT 2022d).

Traffic entering and exiting the pressure regulation station and Cumberland meter station would be limited to those vehicles accessing the location to work at those particular facilities (which is assumed to be well below the total number of workers for the Project). Overall, with approximately 300-400 workers parking in the contractor yards and then bussing or carpooling to locations throughout the Project, impact on traffic would be negligible.

The roads proposed to be utilized during construction have variable design volumes per day in rural areas from less than 15 to 400 for local routes, 300 to 2,600 for major collectors, and 1,500 to 6,000 for minor arterials (Federal Highway Administration [FHWA], 2022). All of the roads proposed to be utilized for construction access are currently operating well below this design capacity except for Highway 250 (Claylick Road).

The [pipeline] is located in rural areas, consisting of primarily undeveloped land. […] Although there may be short-term traffic impacts during construction of the pressure regulation station and the Cumberland meter station, these would be temporary. To mitigate short-term construction impacts, TGP would coordinate with the TDOT and county highway departments. Once the facilities are constructed, they would not require staff to operate the facilities.

3.11.1.3. Alternative B

3.11.1.3.1. Johnsonville Reservation

The Johnsonville reservation is served by highway, railway, and waterway modes of transportation. The closest airport is the Benton County Airport, seven miles west of the site. U.S. Route 70/ Highway 1, also locally known as Broadway Avenue, is the primary arterial roadway serving the JCT site. It has four lanes in western Humphreys County and a center turn lane in New Johnsonville.

There are two points of access into the Johnsonville Reservation from U.S. Route 70 (Figure 2.1-8). An at-grade ramp entrance on the south side of U.S. Route 70 that loops around to the north, crosses over the road and the double CSX Railroad tracks, and then enters JCT on the south side of the reservation, is the main roadway entrance. The Johnsonville Reservation is also accessible from North Street, which intersects U.S. Route 70 about 0.8 miles east of the main access point. North Street runs north from an at-grade intersection with U.S. Route 70, crosses the railroad tracks, and continues north along the east side of JCT.

Existing traffic conditions generated by JCT is composed of a mix of cars and light duty trucks, as well as medium duty to heavy duty trucks. The 2020-21 AADT counts are presented in Table 3.11-3.

Table 3.11-3. Average Daily Traffic Volume (2020-21) on Roadways in Vicinity of JCT

Location (Station Number)	Existing AADT
U.S. Route 70, 2.8 mi east of JCT (43000026)	9,006
U.S. Route 70, 0.8 mi west of JCT (27)	5,120
State Highway 927/Long Street, 1 mi SE of JCT (43000028)	4,134
Country Road 929, 0.8 mi SE of JCT (43000060)	1,905

Source: Tennessee Department of Transportation 2020-21

3.11.1.3.2. Gleason Reservation

The Gleason reservation is served by highway modes of transportation. The closest rail delivery point is in McKenzie, TN, 13 miles from Gleason. The closest airport is the Carroll County Airport, 13 miles southeast of the site. The two-lane Janes Mill Road is the primary roadway serving the reservation, and there are three access points to the west and south sides of the reservation from Janes Mill Road (Figure 2.1-10). Janes Mill Road intersects TN-22, a major four-lane highway in northwest Tennessee, about 0.8 miles south of the Gleason Reservation. Existing traffic generated by the existing Gleason plant is composed of a mix of cars and light duty trucks. The 2020-21 AADT counts are presented in Table 3.11-4.

Table 3.11-4. Average Daily Traffic Volume (2020-21) on Roadways in Proximity to Gleason

Location (Station Number)	Existing AADT
Janes Mill Road, 0.4 mi north of Gleason (92000168)	212
Highway 22/TN-22, 0.8 mi south of Gleason (92000091)	7,184
Parks Road, 1 mi south of Gleason (92000167)	938

Source: Tennessee Department of Transportation 2020-21

3.11.1.3.3. Transmission Corridors

Under Alternative B, TVA would construct an approximately new 40-mile 500-kV TL from Weakley 500-kV station to a new station on the Marshall-Cumberland 500-kV TL, running through Weakley and Henry Counties (Figure 2.1-11). The corridor is served by highway and railway modes of transportation. The closest airport is the Wayne's World Airport (3TN3), 2.3 miles south of the site. The corridor intersects U.S. Route 641 and Highways 22, 118, 89, 190, 140, 69, and 218. All of these highways are two-lane, aside from Highway 22, which is four-lane. The 2020-21 AADT counts are presented in Table 3.11-5.

Table 3.11-5. Average Daily Traffic Volume (2020-21) on Roadways Intersected by Alternative B TL Upgrades

Location (Station Number)	Existing AADT
US-641, 2.7 mi north of the eastern portion of the TL (40000016)	5,095
Highway 22, 0.3 mi SE of the western portion of the TL (92000098)	7,545

Location (Station Number)	Existing AADT
Highway 118, 0.7 mi north of the western portion of the TL (92000128)	996
Highway 89, 0.8 mi north of the western-central portion of the TL (92000170)	1,167
Highway 190, 3.4 mi south of the western-central portion of the TL (92000059)	473
Highway 140, 3.7 mi south of the central portion of the TL (40000046)	586
Highway 69, 2 mi south of the central portion of the TL (40000035)	2,580
Highway 218, 5.7 mi south of the central portion of the TL (40000183)	2,645

Source: Tennessee Department of Transportation 2020-21

3.11.1.4. Alternative C

3.11.1.4.1. Middle Tennessee TVA Power Service Area

TVA anticipates that a portion of the solar facilities proposed under Alternative C would be located in the Middle Tennessee region in order to offset transmission system upgrades that may otherwise be required following the retirement of CUF. As specific sites have not yet been determined for evaluation under this alternative, typical transportation effects of solar and storage construction and transmission projects have been listed under Section 3.2.

3.11.2. Environmental Consequences

3.11.2.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to maintain and operate CUF. TVA would implement all planned actions related to the current and future management and storage of CCRs at the coal plants. Under this alternative, roadway and barge traffic to and from the fossil plant would remain the same.

3.11.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Although traffic on Cumberland City Road, Highway 46, Highway 149 southeast of CUF, and Highway 149 east of CUF may increase during D4 activities as equipment is transported offsite, traffic would ultimately be reduced because of deconstruction of the CUF coal units. Routine plant deliveries would also be discontinued, including coal and limestone, and employment at the plant would be reduced.

Traffic is assumed to be distributed during a peak morning period (to the site) and a peak evening period (away from the site). Deconstruction-related vehicles (dozers, backhoes, graders, loaders, etc.) would be delivered to or removed from the proposed project sites on flatbed trailers. The routes affected by this increased traffic volume have not yet been determined, but it can be assumed that the roadways listed in Table 3.11-1 would be affected. Overall, the traffic volume generated by the construction workforce and the construction-related vehicles would be relatively minor and temporary.

Most of the deconstruction materials would be transported by truck and train off site for recycling and disposal at approved landfills. Recycling and disposal sites have not been determined at this time; thus, haul routes cannot be specified. However, it is estimated that there likely would be an increase in trips near the site for waste disposal and recycling, which would cause minor and temporary increases in traffic volume.

TVA may elect to implement a reclamation process to recover the maximum amount of reusable fuel from the stockpiled material. Stockpiled coal would be burned onsite. Any remaining product would be transported offsite for use or disposal. Scrap metal and other recyclable material would be transported to locations as determined by the demolition contractor. The remaining material would be hauled to the offsite landfill for disposal. Hazardous material, PCB, used oil and universal waste would be disposed of offsite with vendors/locations on TVA's Environmental Restricted Awards List.

Based on this level of use, effects to traffic operations are expected to be relatively minor. Implementation of this action would cause minor effects to the roadway network and localized roadway degradation along the route to the offsite destinations because of increased truck traffic. In addition, the proposed transport of material stockpiled on the site over public roadways would result in an increase in the number of vehicle miles traveled on those roadways. It is anticipated that the additional trips required for waste disposal and project traffic would not change the existing LOS of roadways near the site. However, the increase in vehicle miles is a factor in injury and fatal traffic crash rates. Therefore, there would be a minor effect related to increased traffic and driver safety.

Cumulative effects to roadways may occur as a result of the CCR management activities also occurring on the CUF Reservation, especially if the D4 and CCR management construction occur at the same time. TVA would mitigate congestion or delays near the project sites by implementing appropriate traffic controls, as needed, by staging of trucks, spacing logistics, staggering work shifts, or timing truck traffic to occur during lighter traffic hours. With implementation of these mitigation measures, cumulative effects of the proposed actions to transportation are expected to be minor.

3.11.2.2.1. Environmental Justice Considerations

Transportation effects would be temporary, minor, and concentrated on public roads within a relatively small area around the TVA-owned CUF Reservation, where EJ populations are prominent, and along the haul routes to waste facilities, which have not yet been identified. The increase in vehicle miles would be a factor in injury and fatal traffic crash rates in the area. Therefore, there would be a minor effect related to increased traffic and driver safety. While they would be minimized as much as feasible, these effects would likely be amplified on EJ populations given the location of these elevated traffic effects. Effects to EJ populations resulting from CUF retirement-related traffic on haul routes to waste facilities is not yet known, as these facilities have not been identified. Cumulative effects to EJ populations are also possible, especially if the D4 and CCR management construction occur at the same time.

3.11.2.3. Alternative A

3.11.2.3.1. Construction and Operation of CC Plant, Transmission Lines, and Other Components on CUF Reservation

Vehicular traffic on public roads near the CUF Reservation would increase during construction due to construction workers and materials moving to and from the plant construction areas. The average construction workforce would be about 500 people with occasional higher peaks. TVA estimates an average of 750 workers would be employed onsite at the peak of the approximately three-year construction period. This does not include the construction workforce needed for TL upgrades, if required, as this work is not centralized in one location for any significant period of time. Temporary gravel parking lot(s) would be constructed on site to provide adequate parking for construction staff. Construction materials and plant components would primarily be delivered by truck and large components may be delivered by barge and

unloaded at the existing barge landing. Once the CC plant begins operations, overall truck and barge traffic would decrease due to the reduction of coal and limestone deliveries for the CUF coal plant.

Project materials and equipment would be delivered to the CC plant site by highway for smaller items and railway or waterway for larger items. Improvements to the current barge unloading facilities would consist of grading and creation of dirt/rock ramping to the nose of the barge as well as potential concrete resurfacing and widening. Most delivered items would be placed in project laydown areas on the CC plant site to await installation. Roads within the CUF would be maintained during the construction process. Any temporary access roads constructed offsite would be designed in accordance with USDOT and relevant local requirements. Equipment used during the construction phase would include trucks, truck-mounted augers and drills, excavators, as well as tracked cranes and bulldozers. Once constructed, eight to twelve employees could be needed to operate the CC plant in addition to remaining CUF staff.

Workforce traffic would mainly consist of a mix of passenger cars and light duty trucks. Traffic is assumed to be distributed during a peak morning period (to the site) and a peak evening period (away from the site), but occasional overnight work may be required. Assuming one person per commuting vehicle, there would be a daily average morning inbound traffic volume of 500 vehicles and a daily outbound traffic volume of 500 vehicles for a total of 1,000 vehicles per day. Construction-related vehicles (dozers, backhoes, graders, loaders, etc.) would be delivered to or removed from the CC plant site on flatbed trailers under both the mobilization and demobilization stages of the projects. Additional traffic may cause some traffic delays. Overall, the effect from traffic volume generated by the construction workforce and the construction-related vehicles would have a moderate, short-term impact.

Hazardous materials, PCB, used oil, and universal waste would go for offsite disposal/recycling with vendors/locations on TVA's Environmental Restricted Awards List. Nonhazardous wastes would go for disposal as directed by the contractor. During construction, it can be assumed that there would be an increase in trips near the site for waste disposal and recycling, which would cause minor and temporary increases in traffic volume.

Table 3.11-6. Changes in Traffic on Nearby Roadways During Construction of CUF CC Plant

Location (Station Number)	Existing AADT	Existing AADT Plus Construction Traffic	Temporary Traffic Increase to CUF due to Construction Traffic (%)
Cumberland City Rd, north of CUF (81000059)	3,561	4,761	33.7%
SR-46/Grices Creek Rd, 1.2 mi east of CUF (81000063)	781	1,981	153.6%
Highway 149, 0.8 mi SE of CUF (81000073)	4,941	6,141	24.3%
Highway 149, 0.4 mi east of CUF (81000058)	1,834	3,034	65.4%
Scotts Chapel Road, 1.2 miles west of the CC plant site (81000060)	355	1,555	338.0%

Source: Tennessee Department of Transportation, 2020-21

Implementation of this alternative would cause minor disturbances to the roadway network, and localized roadway degradation along the route to the offsite destinations because of increased truck traffic. The temporary increased traffic over public roadways would result in an increase in the number of vehicle miles traveled on those roadways. This increase in vehicle miles is a

factor in injury and fatal traffic crash rates and would have a minor effect related to increased traffic and driver safety.

Cumulative effects to roadways may occur as a result of the CCR management activities also occurring on the CUF Reservation, especially if the D4 activities and construction for CCR management occur at the same time. TVA would mitigate congestion or delays near the project sites by implementing appropriate traffic controls, as needed, by staging of trucks, spacing logistics, staggering work shifts, or timing truck traffic to occur during lighter traffic hours. With implementation of these mitigation measures, cumulative effects of the proposed actions to transportation are expected to be minor.

3.11.2.3.2. Construction and Operation of Natural Gas Pipeline

Vehicular construction on public roads near the pipeline would increase during construction due to workers and materials moving to and from the pipeline construction areas. TGP has conducted detailed analyses of transportation effects related to the construction and operation of the proposed pipeline as part of the Environmental Report to be submitted with their certificate application that would be filed with FERC for the proposed pipeline. As pipeline construction work is not centralized in one location for any significant period of time, exact traffic increases along roadway intersections cannot be estimated at this time. Approximately two temporary contractor yards would be needed to provide adequate parking for construction staff, contractor management offices, equipment and vehicle staging and storage of pipe and other materials. Construction materials and pipeline components would be delivered by truck. Additional traffic may cause some traffic delays. Once the pipeline begins operations, any traffic increases surrounding the corridor would revert to pre-construction conditions.

TGP's Resource Report 5 (TGP 2022e) states:

> The majority of [pipeline] construction activities would be conducted between the hours of 7:00 a.m. to 7:00 p.m., Monday through Saturday; however, weather conditions, site conditions, and specialized construction techniques (such as HDDs, hydrostatic testing, emergencies, stream crossing timing windows, or blasting) may necessitate nighttime work, extended work hours, or extended work on Sundays and holidays. In the event that TGP conducts these construction activities on a 24 hours per day, 7 days per week schedule, TGP would notify the landowners and seek applicable regulatory approval for such extended work hours. TGP anticipates that certain HDD drilling operations would occur on a 24 hours per day, 7 days per week schedule for approximately 60 days (of the 112-day estimated duration of each HDD) at each of the three HDD locations.

The 2020-21 AADT counts of existing roadways with estimated temporary traffic increases are presented in Table 3.11-7.

Table 3.11-7. Average Daily Traffic Volume (2020-21) on Roadways Intersected by Alternative A Pipeline

Location (Station Number)	Existing AADT	Existing AADT Plus Construction Traffic	Temporary Traffic Increase to CUF due to Construction Traffic (%)
Highway 149, 0.9 mi NE of the pipeline corridor at its western origin point (81000073)	4,941	5,041	2%
TN-13, 2.3 mi NE of the western portion of the corridor (63000045)	603	703	17%
Highway 235, 1 mi south of the midway point of the corridor (22000019)	1,275	1,375	8%
Highway 49, 7.8 mi NE of corridor near the eastern termination point 25 (22000008)	3,358	3,458	3%
Highway 250, 3.3 mi NE of eastern termination point of corridor (11000031)	1,140	1,240	9%

Implementation of this alternative would cause minor disturbances to the roadway network and localized roadway degradation along the route to the offsite destinations because of increased truck traffic. The temporary increased traffic over public roadways would result in an increase in the number of vehicle miles traveled on those roadways. This increase in vehicle miles is a factor in injury and fatal traffic crash rates. Therefore, there would be a minor effect related to increased traffic and driver safety.

As stated by TGP in Resource Report 5 (TGP 2022e):

> Existing transportation networks would experience short-term, minor impacts during construction due to equipment and material deliveries and construction workers commuting to the [pipeline] workspace. For example, construction of the pipeline across paved roads would be accomplished by boring under the roadbed. Construction of the [pipeline] across unpaved roads would be accomplished either by boring under the roadbed or by open-cut methods. To minimize traffic delays at open-cut road crossings of unpaved roads, TGP would establish detours before and during construction. If no reasonable detours are feasible, at least one traffic lane of the road would be left open, except for brief periods when road closure would be required. Minimal impacts to traffic are anticipated for paved or unpaved roads that are crossed by boring. The lanes for these roads would remain open and drivers would be required to reduce speeds at the crossing location. TGP's construction contractors would obtain necessary federal, state, and local roadway transport and load permits necessary to facilitate construction activities for the [pipeline].
>
> Aside from the current operational staff, no additional personnel are anticipated to be hired to operate and maintain the pipeline facilities. Therefore, impacts to traffic and transportation routes from additional personnel commuting to the construction area during normal operations and occasional maintenance site visits are expected

[25] This AADT location was selected due to the fact that it is the closest traffic marker on this particular roadway, which is intersected by the pipeline corridor, despite the marker being distant from the corridor.

to be minimal. Additional site-specific impacts and mitigation for the [pipeline]-related construction activities are provided below.

TGP's construction contractors may implement the following measures, where practicable, to minimize impacts to residents and motorists during construction of the [pipeline], including:

- scheduling oversize/overweight equipment and materials deliveries to occur during non-peak traffic hours and to avoid impacts to school bus routes/schedules;
- using pilot cars for oversize/overweight equipment and material deliveries in designated parking areas;
- employ traffic control measures and work with local school districts to identify school routes and commute times with the goal of minimizing construction traffic along these routes during peak use periods;
- installing signage and/or using flaggers at roadway turnoffs;
- maintaining access to private driveways;
- busing workers to the [pipeline] sites; and
- repairing roads damaged by construction activities).

TVA concurs with TGP's conclusion that minor cumulative effects to roadways may occur as a result of the past/present and RFFAs in proximity to the proposed pipeline. However, effects would be short term and coordination could occur to minimize effects to local commuters.

3.11.2.3.3. Summary of Alternative A

In sum, the majority of traffic impacts resulting from Alternative A would be on public roads near the CUF Reservation, as TL and pipeline activities associated with Alternative A are more dispersed than CC Plant construction and would have a reduced localized impact to any particular set of roadways. Assuming one person per commuting vehicle, there would be a daily average morning inbound traffic volume of 500 vehicles and a daily outbound traffic volume of 500 vehicles for a total of 1,000 vehicles per day to the CC Plant site. Overall, the effect from traffic volume generated by the construction workforce and the construction-related vehicles would have a moderate, short-term impact to driver safety and roadway degradation.

3.11.2.3.4. Environmental Justice Considerations

Transportation effects would be temporary, minor, and concentrated on public roads within a relatively small area around the TVA-owned CUF Reservation, where EJ populations are prominent, and the pipeline corridor, where EJ populations are intermixed with non-EJ populations. At least two temporary contractor yards would provide parking for pipeline construction staff, contractor management offices, equipment and vehicle staging and storage of pipe and other materials, and therefore be activity hubs during construction. Both of the identified contractor yard locations are in EJ areas. While pipeline construction activities would generally be conducted between the hours of 7:00 a.m. to 7:00 p.m., Monday through Saturday, TGP anticipates that certain HDD drilling operations would occur on a 24 hours per day, 7 days per week schedule for approximately 60 days (of the 112-day estimated duration of each HDD) at each of the three HDD locations, all of which are within EJ areas. While they would be minimized by detouring traffic or keeping one lane open, these effects would likely be amplified on EJ populations given the location of these elevated traffic effects.

3.11.2.4. Alternative B

3.11.2.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Project materials and equipment would primarily be delivered to Johnsonville by rail, utilizing the existing rail spur. Equipment used during the construction phase would include trucks, truck-mounted augers and drills, excavators, as well as tracked cranes and bulldozers. TVA estimates a maximum of 180 workers would be employed onsite at the peak of the two-year construction period at Johnsonville. This does not include the construction workforce needed for offsite TL upgrades, if required, as this work is not centralized in one location for any significant period of time. Once constructed, eight to twelve employees could be needed to operate the CTs at JCT in addition to current staff. Assuming one person per commuting vehicle, there would be a peak daily morning inbound traffic volume of 180 vehicles and a daily outbound traffic volume of 180 vehicles for a total of 360 vehicles per day (Table 3.11-8).

The daily workforce during construction of the proposed activities at JCT is expected to be approximately 60 workers per day. Workforce traffic would mainly consist of a mix of passenger cars and light duty trucks (such as delivery trucks). Traffic is assumed to be distributed during a peak morning period (to the site) and a peak evening period (away from the site). Construction-related vehicles (dozers, backhoes, graders, loaders, etc.) would be delivered to or removed from the proposed project sites on flatbed trailers under both the mobilization and demobilization stages of the projects. While the routes for additional traffic volume is not known at this time, this additional traffic may cause marginal traffic delays. Overall, however, the traffic volume generated by the construction workforce and the construction-related vehicles would have a moderate, short-term impact.

Hazardous materials, PCB, used oil, and universal waste would go for offsite disposal/recycling with vendors/locations on TVA's Environmental Restricted Awards List. Nonhazardous wastes would go for disposal as directed by the contractor. Additionally, scrap metal would be recycled at locations as determined by the demolition contractor. While disposal sites have not yet been determined it is estimated that there would be an increase in trips near the site for waste disposal and recycling, which would cause minor and temporary increases in traffic volume.

Minor cumulative effects to transportation, including traffic and local roads, may occur when the action alternative is combined with the proposed Aeroderivative CT project on JCT, particularly if these projects occur concurrently or overlap construction schedules. TVA would mitigate congestion or delays near the project sites by implementing appropriate traffic controls, as needed, by staging of trucks, spacing logistics, staggering work shifts, or timing truck traffic to occur during lighter traffic hours. With implementation of these mitigation measures, cumulative effects of the proposed actions to transportation are expected to be minor.

Table 3.11-8. Changes in Traffic on Nearby Roadways During Construction of JCT CT Plant

Location (Station Number)	Existing AADT	Existing AADT Plus Construction Traffic	Temporary Traffic Increase to JCT due to Construction Traffic (%)
U.S. Route 70, 2.8 mi east of JCT (43000026)	9,006	9,366	4.0%
U.S. Route 70, 0.8 mi west of JCT (27)	5,120	5,480	7.0%
State Highway 927/Long Street, 1 mi SE of JCT (43000028)	4,134	4,494	8.7%
Country Road 929, 0.8 mi SE of JCT (43000060)	1,905	2,265	18.9%

3.11.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

For the Gleason site, major project components would primarily be delivered to McKenzie, TN by rail, then delivered to the project site by truck and placed in designated project laydown areas until used. It is approximately 13 miles from the rail station to the Gleason site, and it is estimated that approximately 10 truck trips would be needed for the delivery of materials from the rail station to Gleason. All other project materials would be delivered by truck. Equipment used during the construction phase would include trucks, truck-mounted augers and drills, excavators, as well as tracked cranes and bulldozers. TVA estimates a maximum of 180 workers would be employed onsite at the peak of the two-year construction period for each plant site. This does not include the construction workforce needed for offsite TL upgrades, if required, as this work is not centralized in one location for any significant period of time. Once constructed, eight to twelve employees could be needed to operate the CTs at Gleason in addition to current staff. Assuming one person per commuting vehicle, there would be a peak daily morning inbound traffic volume of 180 vehicles and a daily outbound traffic volume of 180 vehicles for a total of 360 vehicles per day (Table 3.11-9).

The daily workforce during construction of the proposed activities at Gleason is expected to be approximately 60 workers per day. Workforce traffic would mainly consist of a mix of passenger cars and light duty trucks (such as delivery trucks). Traffic is assumed to be distributed during a peak morning period (to the site) and a peak evening period (away from the site). Additional traffic may cause some traffic delays. Overall, however, the traffic volume generated by the construction workforce and the construction-related vehicles would be relatively minor and temporary.

Hazardous materials, PCB, used oil, and universal waste would go for offsite disposal/recycling with vendors/locations on TVA's Environmental Restricted Awards List. Nonhazardous wastes would go for disposal as directed by the contractor. Additionally, scrap metal would be recycled at locations as determined by the demolition contractor. While disposal sites have not yet been determined, it is estimated that there would be an increase in trips near the site for waste disposal and recycling, which would cause minor and temporary increases in traffic volume.

No cumulative effects to transportation are anticipated at the Gleason Reservation based on the minor and temporary effects to traffic volume and in consideration of the absence of RFFAs at Gleason.

Table 3.11-9. Changes in Traffic Effects on Nearby Roadways During Construction of Gleason CT Plant

Location (Station Number)	Existing AADT	Existing AADT Plus Construction Traffic	Temporary Traffic Increase to Gleason due to Construction Traffic (%)
Janes Mill Road, 0.4 mi north of Gleason (92000168)	212	572	169.8%
Highway 22/TN-22, 0.8 mi south of Gleason (92000091)	7,184	7,544	5.0%
Parks Road, 1 mi south of Gleason (92000167)	938	1,298	38.4%

3.11.2.4.3. Transmission and Other Components

Minor transportation effects would occur as a result of increased workforce traffic during the construction of the 40-mile transmission line associated with Alternative B. This work is not centralized in one location for any significant period of time. Because TL construction would occur over a 40-mile range, traffic effects due to construction would be widely distributed along the length of the line. Thus, it can be assumed that increases in traffic volume would be minor and temporary.

Implementation of this alternative would cause minor disturbances to the roadway network, and localized roadway degradation along the route to the offsite destinations because of increased truck traffic. The temporary increased traffic over public roadways would result in an increase in the number of vehicle miles traveled on those roadways. This increase in vehicle miles is a factor in injury and fatal traffic crash rates and would have a minor effect related to increased traffic and driver safety.

3.11.2.4.4. Environmental Justice Considerations

Transportation effects would be temporary, minor, and concentrated on public roads within a relatively small area around the TVA-owned JCT and Gleason Reservations and transmission lines. These effects would likely not be amplified on EJ populations in the vicinity of the Gleason Reservation. However, since the census block groups immediately adjacent to JCT are qualifying low-income and minority populations, amplified effects to EJ populations may occur.

3.11.2.5. Alternative C

3.11.2.5.1. Construction and Operation of Solar and Storage Facilities

Traffic associated with the construction of solar facilities would include semi-truck trips to deliver materials and construction equipment to the site and remove packaging materials; employee passenger vehicles; dump trucks; and concrete trucks. During operations, project-specific traffic would largely be reduced to daily employee trips for security, maintenance, and repairs onsite with occasional larger vehicles such as crane trucks and forklifts being transported onsite for maintenance as needed. For reference, 80 employees were utilized during the construction period of the 20-MW TVA Cumberland Solar Project (4 employees per MW), and 250 employees were utilized during the construction period of the 150-MW TVA Elora Solar Energy Center (or 1.7 employees per MW) (TVA 2018b, TVA 2020a). Temporary traffic increases may be mitigated, if necessary, by staggered construction work shifts, use of flagmen, broadcasting delays and highlighting alternate routes on news channels, radio, and on signage.

Minor cumulative effects to traffic and transportation may occur if the timing for Alternative C coincides with the proposed expansion of 10,000 MW of solar facilities by 2035. Additional construction traffic and workforce traffic may be experienced on highways and local roads. However, effects would be short term and coordination could occur to minimize effects to local travelers.

3.11.2.5.2. Transmission and Other Components

Minor transportation effects would occur as a result of increased workforce traffic during the construction of the transmission lines associated with the solar and storage sites under Alternative C. This work is not centralized in one location for any significant period of time. Transportation changes as a result of TL construction cannot be determined at this time and would be part of future NEPA reviews. Increases in traffic volume would be minor and temporary.

3.12. Utilities

3.12.1. Affected Environment

3.12.1.1. CUF Reservation

The CUF Site is located in an industrial and agricultural area in Cumberland City, Stewart County, TN. In addition to various mobile providers, telecommunication services in the Project Site vicinity are provided by AT&T, HughesNet, and Viasat (AT&T 2021; HughesNet 2021; Viasat 2021).

Electrical service is provided by Cumberland Electric Membership Corporation (CEMC), which distributes power provided by TVA (CEMC 2021). Existing power lines are present in the project area along Wickham Ave, Old Hwy 149, Cumberland City Rd, and other major and minor roads in the vicinity. Nine TL ROWs extend through the CUF site. TVA's Cumberland 161-kV TLs cross the southern portion of the site in a northeast-southwest and a southeast-west orientation. TVA's Cumberland 500-kV TLs cross the western portion of the site in an east-west orientation (U.S. Energy Information Administration [EIA] 2021). There is not currently natural gas service in Cumberland City (Town of Cumberland City; personal communication; September 24, 2021).

As of 2015, the two coal-fired units at CUF had a water withdrawal rate of 2,319.2 MGD and a return of 2,311.6 MGD. With a net generation of 14,438,617 megawatt hours/year, CUF has a water use factor of 58,627 gallons/ megawatt hour (MWh) (TVA 2019b). According to the Town of Cumberland City, water service in the Project Site vicinity is provided either by the City of Erin or private wells and septic systems. Due to being predominantly outside of incorporated municipality limits, water service at CUF and within the Project Site vicinity is provided either by the Cumberland City Utilities or private wells and septic systems (Town of Cumberland City; personal communication; September 24, 2021). Given their respective proximity to CUF, the residences located adjacent to the southern and northern portions of the Project Site may have water service from Cumberland City Utilities.

3.12.1.2. Alternative A

3.12.1.2.1. Proposed CC Plant Site

Utilities in the vicinity of the proposed CC plant site are generally described in Section 3.12.1.1.

3.12.1.2.2. Natural Gas Pipeline Corridor

The proposed pipeline lateral (approximately 32-miles) associated with Alternative A commences at milepost 0 in Dickson County at an interconnection with TGP's existing Lines

100-3 and 100-4, runs northwest through Houston County, and terminates at milepost 32 at the CUF site in Stewart County. The corridor is largely developed open space in rural areas with some roadway intersections. The following provides a summary of existing utilities in proximity to the pipeline lateral. In addition to various mobile providers, telecommunication services in the corridor's vicinity are provided by AT&T, Xfinity, HughesNet, TEC, and Viasat (AT&T 2021; Xfinity 2021; HughesNet 2021; TEC 2021; Viasat 2021). In the vicinity of the corridor, electrical service is provided by CEMC, Meriwether Lewis Electric Cooperative, and Dickson Electric. Natural gas is distributed by the West Tennessee Public Utilities District. Given the rural nature of the area, the residences located adjacent to the corridor are not anticipated to have natural gas service. The West Tennessee Public Utilities District indicated that rural areas outside of city limits are less likely to have gas services (West Tennessee Public Utilities District, personal communication, October 2021).

As noted in Section 2.1.3.2.1, the CUF reservation is located 30 miles from a major interstate pipeline with adequate capacity to serve a new CC plant. The construction and operation of a new CC plant would require construction of approximately 32 miles of new 30-inch-diameter natural gas pipeline lateral and associated gas system infrastructure in Dickson, Houston, and Stewart counties. The proposed gas pipeline lateral overview map shown on Figure 2.1-6 identifies the approximate route of a primary supply line that would be generally built along a 500 kV TL ROW. Due to the rural nature of the corridor, water supply may come from private wells or sewer systems, aside from the origination point of the corridor, which would likely utilize the same water source as CUF. Due to being predominantly outside of incorporated municipality limits, water service along the corridor is likely provided by private wells and septic systems. The residents in the areas of the corridor near Erin may have water provided by the City of Erin Water Department.

As stated in TGP's Resource Report 2:

> An estimated 40 percent of residents in Dickson County, 5 percent of residents in Houston County, and 45 percent of residents in Stewart County rely on well water (NY Times 2012a, 2012b, 2012c). TGP would offer to conduct pre- and/or post-construction water sampling for all public and private groundwater supply wells and potable springs within a) 150 feet of the pipeline construction ROW or AWTS where no karst terrain is present, or b) 1,000 feet where karst terrain is present. Landowners with water supplies located outside of the monitoring area may request pre- and/or post-construction water sampling. In these cases, sampling would follow the same schedule and methodology as water wells and potable springs located within the monitoring area. A qualified, independent contractor would perform the pre- and post-construction testing. TGP would also offer to conduct pre- and/or post-construction water sampling for all municipal and public groundwater wells within 400 feet of the Project area. A review of the USGS National Waters Information System (USGS 2019) and coordination with affected landowners was completed to determine whether groundwater wells or springs occur within the buffer zones described above. Additional surveys, landowner discussions, and consultation with local officials are ongoing and any additional information regarding water wells and potable springs would be provided when available.

3.12.1.3. Alternative B

3.12.1.3.1. Johnsonville Reservation

The JCT is located in an industrial area near New Johnsonville in Humphreys County, Tennessee. In addition to various mobile providers, telecommunication services in the Project Site vicinity are provided by HughesNet, Viasat, and TDS (TDS 2021; HughesNet 2021; Viasat 2021).

In the JCT site vicinity, electrical service is provided by Meriwether Lewis Electric Cooperative (MLEC), which distributes power provided by TVA (MLEC 2021). Existing power lines are present in the project area along North Street and other major and minor roads in the vicinity. Natural gas is distributed by the Humphreys County Utility District. As the JCT is located within the city limits, the residences located adjacent to the JCT would likely have natural gas service (Humphreys County Utility District 2021). Water service at JCT and in the JCT vicinity is provided by the City of New Johnsonville Water Department. As JCT is located within the city limits, the residences located adjacent to JCT may have water service from the City of New Johnsonville Water Department.

3.12.1.3.2. Gleason Reservation

The Project Site is located in a rural, unincorporated area near Dresden in Weakley County, Tennessee. In addition to various mobile providers, telecommunication services in the Gleason site vicinity are provided by AT&T, HughesNet, Viasat, EarthLink, and Spectrum (AT&T 2021; HughesNet 2021; Viasat 2021; EarthLink 2021; Spectrum 2021). In the vicinity of the site, electrical service is provided by Weakley County Municipal Electric System (WCMES), which distributes power provided by TVA (WCMES 2021). Existing power lines are present in the project area along Janes Mill Road and other major and minor roads in the vicinity. Natural gas is distributed by the West Tennessee Public Utilities District. Due to the site's location outside of incorporated municipality limits, water service at Gleason and in the vicinity of the Project Site is provided either by Gleason Water & Wastewater or private wells and septic systems (Gleason Water & Wastewater 2021).

3.12.1.3.3. Transmission Corridors

The 40-mile TL associated with Alternative B begins east of Highway 45 in Weakley County and terminates west of Austin Peay Memorial Highway in Henry County, 28 miles northwest of the JCT site. The TL corridor is largely agricultural with intersections with Highways and State Routes. In addition to various mobile providers, telecommunication services in the corridor's vicinity are provided by AT&T, HughesNet, Viasat, EarthLink, and Spectrum (AT&T 2021; HughesNet 2021; Viasat 2021; EarthLink 2021; Spectrum 2021). In the vicinity of the site, electrical service is provided by Weakley County Municipal Electric System (WCMES), which distributes power provided by TVA (WCMES 2021). Natural gas is distributed by the West Tennessee Public Utilities District. Given the rural nature of the area, the residences located adjacent to the corridor may not have natural gas service (West Tennessee Public Utilities District, personal communication, October 2021). Due to being predominantly outside of incorporated municipality limits, water service along the corridor is likely provided by private wells and septic systems. The residents in the areas of the corridor near Dresden may have water provided by the Dresden Water Department.

3.12.1.4. Alternative C

3.12.1.4.1. Middle Tennessee TVA Power Service Area

Middle Tennessee power from the proposed solar and storage facilities would typically be delivered by direct connection to TVA's transmission system or via interconnections with local

power companies that distribute power from TVA. Effects on local utilities would be assessed in future NEPA reviews for each solar and storage site.

TVA anticipates that a portion of the solar facilities proposed under Alternative C would be physically located in the Middle Tennessee region in order to offset transmission system upgrades that otherwise may be required following the retirement of CUF. The TVA PSA contains most of the Tennessee River Basin, which is considered one of the most water rich basins in the United States (TVA 2019b). The Tennessee River Basin, which is about half of the TVA PSA, has been defined as the most intensively used basin in the contiguous United States as measured by intensity of freshwater withdrawals in gallons per day per square mile (gal/d/mi2) (Hutson et al. 2004). While the withdrawal rate is highest, the basin has the lowest consumptive use in the nation by returning about 96 percent of the withdrawals back for downstream use (Bowen and Springston 2018).

In 2015, estimated average daily water withdrawals in the TVA PSA totaled 12,966 MGD (Dieter et al. 2018, Bowen and Springston 2018). About 6.6 percent of these water withdrawals were groundwater and the remainder was surface water. The largest water use (77.7 percent of all withdrawals) was for thermoelectric generation as shown in Figure 3.12-1. Even though thermoelectric generation has the greatest withdrawal, about 99.2 percent is recycled and returned for downstream use in the TVA system (Bowen and Springston 2018).

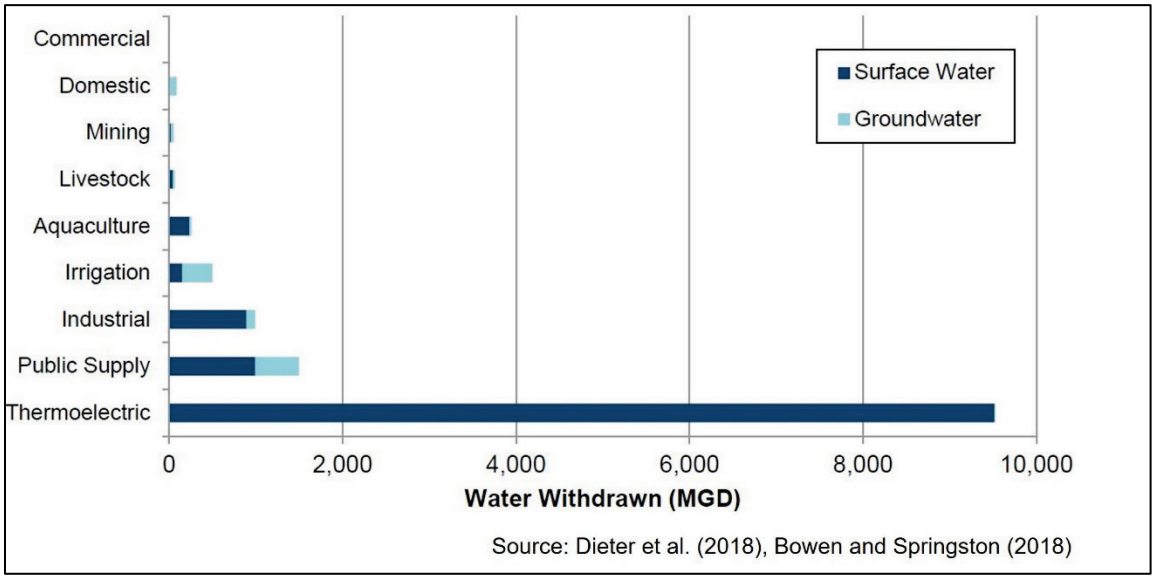

Figure 3.12-1. 2015 water withdrawals in the TVA power service area by source and type of use

Since 1950, the annual increase in groundwater withdrawals for public supply in Tennessee has averaged about 2.2 percent and the increase in surface water withdrawals has averaged about 3.5 percent (Figure 3.12-2). For the first time since 1950, there was a decrease in surface water withdrawal for public supply systems in Tennessee between 2010 and 2015. Although these data are for Tennessee public water supplies, they are representative of the overall trends in water use for the TVA PSA.

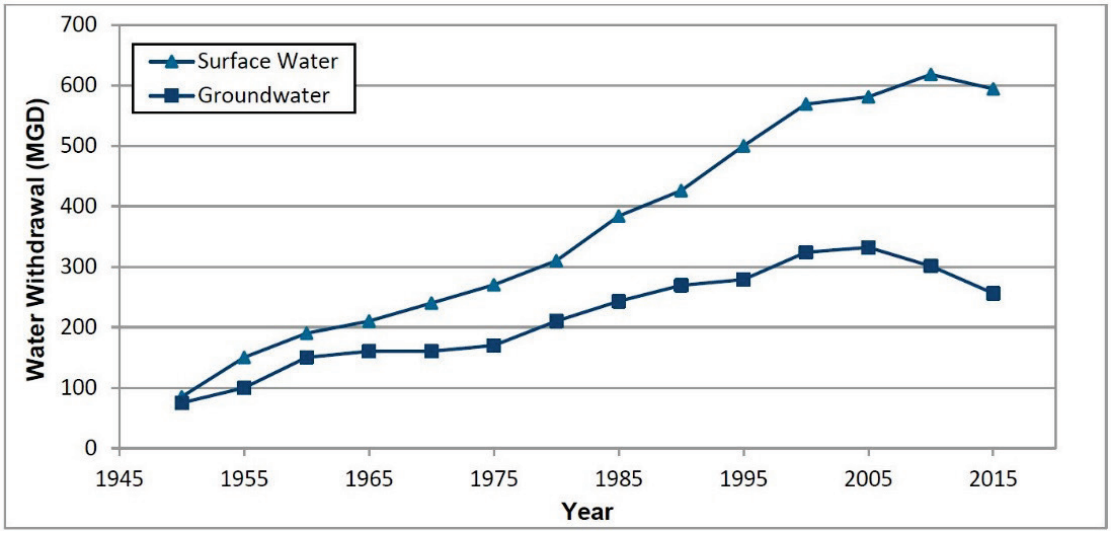

Figure 3.12-2. Groundwater and surface water withdrawals by water public systems in Tennessee, 1950 to 2015. Source: Adapted from Webbers (2003). Additional Data: Kenny et al. (2009), Bohac and Bowen (2012), Bowen and Springston (2018).

3.12.2. Environmental Consequences

3.12.2.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to operate and maintain the coal-fired units at CUF; therefore, no project-related effects to local utilities would occur. Existing on-site utilities would likely remain unchanged, with the exception of potential upgrades and maintenance.

3.12.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Under all Action Alternatives, TVA would retire, decommission, deactivate, decontaminate, and deconstruct the CUF units and site. All buried utilities would be cut and capped within the project boundary and abandoned in place if they do not interfere with other ongoing projects in the vicinity. All hollow pipe utilities would be decommissioned and sealed with a mechanical cap or plug. The site would be restored to grade to provide proper drainage. The 161-kV and 500-kV switchyards would remain in place.

Additional modifications to existing utilities on or surrounding the CUF site would occur with implementation of Alternative A, as detailed in Section 2.1.3.2.2. Electrical service to CUF would be provided by CEMC, and CEMC would coordinate with customers if outages were necessary. The project would obtain water by connection to a municipal source or by delivery via water trucks, if necessary. Thus, water service for the project may be obtained through the City of Erin Water Department. No cumulative effects to utilities are anticipated.

3.12.2.2.1. Environmental Justice Considerations

Short-term utility outages associated with CUF retirement and D4 activities, if necessary, would be minor and would occur in the immediate vicinity of the TVA-owned CUF Reservation, where EJ populations are prominent. While minimized as much as feasible, amplified effects on EJ populations are possible.

3.12.2.3. Alternative A

3.12.2.3.1. Construction and Operation of CC Plant, Transmission Lines, and Other Components at CUF Plant Site

Under Alternative A, TVA would construct a new CC plant of approximately 1,450 MW at CUF including transmission lines and other components. The CC plant would be fueled by a reliable supply of natural gas from the proposed 32-mile-long pipeline. The potential corridor for the 32-mile-long new natural gas pipeline is generally located adjacent to an existing TVA transmission line extending from Dickson County, through Houston County and terminating at the proposed CC plant in Stewart County. TVA would construct a new switchyard at the CC plant connecting two 500-kV TLs to an existing TVA 500-kv TL ROW and make other transmission system modifications to transmit the energy generated by the new CC plant.

Natural gas-fueled CC plants (gas turbine followed by a steam turbine) require water for steam generation and condensation. As of 2015, the water use factors for TVA's CC plants ranged from 208–935 gallons/MWh. TVA has elected to use air cooling, however, at the CC plant to significantly minimize effects to the nearby Cumberland River, groundwater, or overall water supply. The facility would require potable water, which would be obtained from the existing public supply at CUF (City of Erin Water Department).

CC compressor washing also requires demineralized water. Wash effluent would be collected in tanks and, after analysis, disposed of at an approved wastewater treatment facility off-site. Demineralized water would be made onsite and stored onsite in two, one-million-gallon tanks that would be constructed at the time of the CC plant.

The replacement of the CUF coal-fired units with CC units would result in reduced water use at the site (TVA 2019b). Construction of CC plant components at CUF would require below-ground construction activities that may encounter groundwater. Such activities include installation of deep foundations, if needed, to support the proposed CC plant and associated facilities. However, because such activities and their effects to groundwater patterns or availability are localized and generally limited to the construction phase, effects from construction are expected to be minor. TLs and switchyards do not require water to operate, so water supply use would be limited to the construction period and therefore temporary.

Prior to starting plant construction, TVA would coordinate with existing telecommunications, electricity, natural gas, and water and sewer utilities. Adverse effects to existing utilities would not occur. No cumulative effects to utilities are anticipated.

3.12.2.3.2. Construction and Operation of Natural Gas Pipeline

The construction and operation of a new CC plant would require construction of approximately 32 miles of new natural gas pipeline lateral and gas system infrastructure to connect the plant to the new gas pipeline lateral. Compression requirements, if any, would be determined by the technical requirements of the CT brand chosen and located on the CUF Reservation. TGP has assessed utility effects as part of the Environmental Report, which TVA draws upon for this analysis. Service disruptions would be minimized through coordination between TGP, TVA, and the affected utilities.

Water supply for construction would be obtained from various sources such as local wells, ponds, trucking-in water or municipal sources. The excavation of the pipeline trench to the necessary depth may encounter groundwater. However, because such activities and their effects to groundwater patterns or availability are localized and generally limited to the construction phase, effects from construction are expected to be minor.

As stated in Resource Report 2 (TGP 2022b):

> Prior to and during construction, TGP will work with individual landowners to locate public, unmarked, and private waterlines prior to ground disturbing activities. If temporary waterline shutoffs are necessary during construction […], TGP will coordinate with any affected landowners or other parties in advance and will provide a temporary source of water (e.g., contracting with a local water supply firm to deliver potable water) for the duration of the shutoff. […] In such instances, the potential impacts and proposed mitigation measures would be similar to those described for construction activities. Applicable permits and approvals for temporary disturbances resulting from operation and maintenance activities would be obtained as necessary. No cumulative effects to utilities are anticipated.
>
> TGP communicates regularly with emergency responders (police, sheriff, fire, and medical professionals), local officials, and contractors in all counties, cities, and towns where it operates […]. Annually, TGP's local employees contact local emergency responders to answer questions and provide additional information related to emergency response, safety, and local contact information. As the pipeline is constructed, placed in-service, and operated as part of the TGP system, TGP would continue these activities in counties where its facilities are located and would begin those activities in counties where new facilities are added. These periodic meetings or contacts are conducted in person, when possible, to allow TGP operations personnel to provide information about the company, including contact information, high level maps of the pipeline systems, and potential risks regarding natural gas releases and planned responses in the event of an emergency event.
>
> TGP also hosts training sessions periodically for emergency responders in the counties where facilities are located. TGP would continue to make contact with applicable emergency responders each year to ensure that the contact information is accurate, answer any questions, and offer follow-up training. In addition to these in-person meetings and contacts, TGP sends information to all public contacts located within approximately 1,000 feet of TGP facilities. Emergency responders located within this area would receive these mailings as well. During operation of the [pipeline facilities], the largest impact to public services would be associated with an emergency affecting the reliability or integrity of the natural gas facilities. The pipeline system includes design and equipment features, in addition to routine inspection and maintenance programs, that are designed to increase overall safety of the system [(TGP 2022e)].

The replacement of the CUF coal-fired units with CC units would result in reduced water use at the site (TVA 2019b). Groundwater effects from below-ground construction are expected to be minor. TLs and switchyards do not require water to operate, so water supply use would be limited to the construction period and therefore temporary. If temporary waterline shutoffs are necessary during pipeline construction, TGP would coordinate with any affected landowners or other parties in advance and would provide a temporary source of water. Project operations are not expected to result in impacts to public or private water supplies unless operation and maintenance activities involving pipe excavation and repairs are needed.

3.12.2.3.3. Summary of Alternative A

Overall, long-term beneficial impacts would occur due to reduced water use at the CUF site and the replacement of the CUF plant with a 1,450 MW CC Plant. Service disruptions associated with Alternative A construction are expected to be minimized through coordination with impacted utilities. Groundwater effects from below-ground construction are expected to be minor. TLs and switchyards do not require water to operate, so water supply use would be limited to the construction period and therefore temporary. If temporary waterline shutoffs are necessary during pipeline construction, TGP would coordinate with any affected landowners or other parties in advance and would provide a temporary source of water. Project operations are not expected to result in impacts to public or private water supplies unless operation and maintenance activities involving pipe excavation and repairs are needed.

3.12.2.4. Alternative B

TVA proposes to construct CT plants with a combined total capacity of approximately 1,530 MW on the JCT and Gleason Reservations. Both sites currently have operating natural gas-fired generation facilities, adequate natural gas supply, and include transmission interconnections to the TVA system.

3.12.2.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Some water treatment may be required to support the new CT plants under Alternative B. The plant would require potable water, which would be obtained from the City of New Johnsonville Water Department. Up to about 130 GPM at JCT would be used for inlet air evaporative cooling in summer ambient temperatures. Potable water for domestic use and safety showers would be obtained from the existing public supply. The replacement of the CUF coal-fired units with CT units would result in an overall reduction in water use (TVA 2019b).

The CT plant would be fueled by a reliable supply of natural gas. Preliminary estimates indicate an upper bound of 220 MCF/day of natural gas would be needed to fuel the CT plant at JCT, running at maximum capacity. This demand would require piping to connect the CT plant to the existing natural gas pipeline lateral and metering station, and any necessary expansion of the existing metering station would be accommodated within the existing reservation boundaries. New gas compression would likely be needed at Johnsonville, which would be located onsite and constructed and operated by TVA.

Electrical service to JCT is provided by MLEC, and MLEC would coordinate with customers if outages were necessary. TVA would coordinate with existing telecommunications, electricity, natural gas, and water and sewer utilities prior to starting construction. Adverse effects to existing utilities would not occur. No cumulative effects to utilities are anticipated.

3.12.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

Some water treatment may be required to support the new CT plant under Alternative B. The plant would require potable water, which would be obtained from Gleason Water & Wastewater. Up to about 100 GPM at Gleason would be used for inlet air evaporative cooling in summer ambient temperatures. Potable water for domestic use and safety showers would be obtained from the existing public supply. The replacement of the CUF coal-fired units with CT units would result in an overall reduced water use (TVA 2019b). New gas compression may be required at Gleason to supply the new CT plant.

At the Gleason site, the CT plant would also be fueled by a reliable supply of up to 165 million standard cubic feet per day of natural gas, with Gleason running at maximum capacity. This demand would require piping to connect the CT plant to the existing natural gas pipeline lateral and metering station, and any necessary expansion of the existing metering station would be

accommodated within the existing reservation boundaries. New gas compression would likely be needed at Gleason, which would be located onsite and constructed and operated by TVA.

Electrical service to Gleason is provided by WCMES, and WCMES would coordinate with customers if outages were necessary. TVA would coordinate with existing telecommunications, electricity, natural gas, and water and sewer utilities prior to starting construction. Adverse effects to existing utilities would not occur. No cumulative effects to utilities are anticipated.

3.12.2.4.3. Transmission and Other Components

The onsite transmission system modifications necessary to transmit the energy generated by the proposed Johnsonville and Gleason CT plants are described in Section 2.1.4.4. Alternative B would also require the construction of a new approximately 40-mile, 500-kV TL in Weakley and Henry counties. The components of this TL would be sited in a manner to avoid effects to existing utilities, such as electrical distribution lines and buried pipelines, within or in the vicinity of the construction corridor. Prior to initiating construction, TVA would coordinate with the potentially affected utilities and mitigate any potential effects to the utilities. Any utility service interruptions would be minimized and overall effects to area utilities would be minimal. TLs and switchyards do not require water to operate, so water supply would not be impacted due to the transmission upgrades associated with this alternative.

3.12.2.4.4. Environmental Justice Considerations

While utilities-related effects may be experienced by EJ populations in the pipeline corridor, effects are anticipated to be limited to construction, except for maintenance activities that may involve excavation and repair. These minimal to minor effects may be amplified on EJ populations given their prominence in the vicinity.

3.12.2.5. Alternative C

3.12.2.5.1. Construction and Operation of Solar and Storage Facilities

Under Alternative C, TVA would add 3,000 MW of solar generating facilities paired with 1,700 MW of battery storage facilities, primarily in Middle Tennessee, utilizing a combination of PPAs with third-party developers and TVA-built and operated facilities. PV facilities do not typically require a water source for operation but may require potable water for onsite facilities or sewer during operation. BESS facilities typically require a water supply to support fire safety systems. Both PV and BESS facilities typically require electrical service and telecommunications services. Utility effects would be minimized by identifying and coordinating with utilities early prior to construction to avoid service disruptions. Minor effects to existing utilities or water supply are anticipated under Alternative C. While additional solar facilities may be constructed in Middle Tennessee, cumulative effects would be minor as developers and TVA would identify utility locations early and coordinate to avoid disruptions.

3.12.2.5.2. Transmission and Other Components

The construction of TLs associated with solar and BESS sites would not affect water supply or other utilities. The components of any necessary TLs would be sited in a manner to avoid effects to existing utilities, such as electrical distribution lines and buried pipelines, within or in the vicinity of the construction corridor. Prior to initiating construction, TVA would coordinate with the potentially affected utilities and mitigate any potential effects to the utilities. Any utility service interruptions would be minimized and overall effects to area utilities would be minimal. TLs and switchyards do not require water to operate, so water supply would not be impacted due to the transmission upgrades associated with this alternative.

3.13. Cultural Resources

3.13.1. Regulatory Framework

Cultural resources include Pre-Contact and historic archaeological sites, districts, buildings, structures, and objects, as well as locations of important historic events that lack material evidence of those events. Cultural resources are considered historic properties if included in, or considered eligible for inclusion in, the National Register of Historic Places (NRHP) maintained by the NPS. The eligibility of a resource for inclusion in the NRHP is based on the Secretary of the Interior's criteria for evaluation (36 CFR § 60.4), which state that significant cultural resources possess integrity of location, design, setting, materials, workmanship, feeling and association, and:

1) are associated with important historical events; or
2) are associated with the lives of significant historic persons; or
3) embody distinctive characteristics of a type, period, or method of construction or represent the work of a master, or have high artistic value; or
4) have yielded or may yield information (data) important in history or prehistory.

Because of their importance to the Nation's heritage, historic properties are protected by several laws. Federal agencies, including TVA, have a statutory obligation to facilitate the preservation of historic properties, stemming primarily from the National Historic Preservation Act (NHPA; 16 U.S.C. §§ 470 et seq.). Other relevant laws include the Archaeological and Historic Preservation Act (16 U.S.C. §§ 469-469c), Archaeological Resources Protection Act (16 U.S.C. §§ 470aa-470mm) and the Native American Graves Protection and Repatriation Act (25 U.S.C. §§ 3001-3013).

Section 106 of the NHPA requires federal agencies to consider the potential effects of their actions on historic properties and to allow the Advisory Council on Historic Preservation an opportunity to comment on the action. Section 106 involves four steps: 1) initiate the process; 2) identify historic properties; 3) assess adverse effects; and 4) resolve adverse effects. This process is carried out in consultation with the State Historic Preservation Officer (SHPO) of the state in which the action would occur and with any other interested consulting parties, including federally recognized Indian tribes.

Section 110 of the NHPA sets out the broad historic preservation responsibilities of federal agencies and is intended to ensure that historic preservation is fully integrated into their ongoing programs. Federal agencies are responsible for identifying and protecting historic properties and avoiding unnecessary damage to them. Section 110 also charges each federal agency with the affirmative responsibility for considering projects and programs that further the purposes of the NHPA, and it declares that the costs of preservation activities are eligible project costs in all undertakings conducted or assisted by a federal agency.

3.13.2. Affected Environment

Existing conditions for cultural resources are presented for the vicinity of the project sites, where concentrated project effects to this resource area could occur. Project affected environments are also assessed for the proposed natural gas pipeline lateral, new TLs, and TL upgrade activities.

3.13.2.1. CUF Reservation

There have been several field-based cultural resources surveys previously completed within the boundaries of the CUF Reservation, documenting 32 recorded archaeological sites within the CUF Reservation. These sites are summarized in Table 3.13-1. Five of these sites (40SW702, 40SW720, 40SW721, 40SW723, and 40SW799) contain historic cemeteries. Ten of these sites (40SW63, 40SW703, 40SW704, 40SW708, 40SW710, 40SW711, 40SW715, 40SW719, 40SW723, and 40SW702/1285974), indicated by boldface type in Table 3.13-1, are located within or immediately adjacent to the potential CC plant site on the CUF Reservation or within the proposed transmission corridor. TVA included CUF in a historic architectural assessment in 2008; no NRHP-eligible resources were identified. In June 2022, TRC conducted an NRHP evaluation of CUF and recommended to TVA that it is not eligible for the NRHP due to the loss of integrity caused by modern alterations that have occurred to the facility within the past 50 years. The TN SHPO agreed that CUF was not eligible for the NRHP. Correspondence between the TN SHPO and TVA for a number of projects associated with the CUF Reservation is presented in Appendix M.

Table 3.13-1. Recorded Archaeological Sites Within the CUF Reservation

Site Number	Site Type	NRHP Recommendation
40SW49	Pre-Contact nondiagnostic open habitation	Undetermined
40SW63*	**Pre-Contact Early to Late Archaic and Early to Middle Woodland open habitation**	**Potentially Eligible**
40SW201	Pre-Contact Late Archaic, Woodland, and Mississippian open habitation	Undetermined
40SW219	Early to middle 19th century iron furnace	Listed; mitigated and destroyed
40SW699	Early to middle 19th century iron mining pits	Not Eligible
40SW701	Pre-Contact nondiagnostic open habitation; 19th and 20th century historic scatter	Not Eligible
40SW702/1285974	**Pre-Contact Late Archaic to Early Woodland open habitation; 1800-1950 Graveyard Hill Cemetery**	**Potentially Eligible**
40SW703	**Pre-Contact nondiagnostic open habitation**	**Not Eligible**
40SW704	**Pre-Contact nondiagnostic open habitation**	**Not Eligible**
40SW705	Pre-Contact nondiagnostic open habitation	Not Eligible
40SW706	Pre-Contact nondiagnostic open habitation	Not Eligible
40SW708	**Pre-Contact nondiagnostic open habitation**	**Not Eligible**
40SW710	**Pre-Contact Middle to Late Archaic open habitation; 20th century domestic scatter**	**Potentially Eligible**
40SW711	**Pre-Contact nondiagnostic open habitation**	**Not Eligible**
40SW712	Pre-Contact nondiagnostic open habitation	Not Eligible
40SW713	Pre-Contact nondiagnostic open habitation	Not Eligible
40SW714	Pre-Contact nondiagnostic open habitation	Not Eligible
40SW715	**Pre-Contact nondiagnostic open habitation**	**Not Eligible**

Site Number	Site Type	NRHP Recommendation
40SW716	Early to middle 20th century farmstead	Not Eligible
40SW717	Middle 19th to 20th century roadbed	Not Eligible
40SW719	**Middle 19th to 20th century roadbed**	**Not Eligible**
40SW720	1900-2011 Parrott Cemetery	Not Eligible
40SW721	1900-1950 Brosheer Cemetery	Not Eligible
40SW722	Early to middle 19th century iron mining pit	Not Eligible
40SW723	**Family cemetery**	**Eligible**
40SW796	Pre-Contact nondiagnostic open habitation	Recommended Not Eligible
40SW797	Pre-Contact nondiagnostic open habitation	Recommended Not Eligible
40SW798	Pre-Contact non-diagnostic open habitation	Recommended Not Eligible
40SW799	Pre-Contact nondiagnostic open habitation; 1720-1860 private cemetery	Undetermined
40SW800	Pre-Contact nondiagnostic open habitation	Recommended Not Eligible
40SW801	Pre-Contact nondiagnostic open habitation	Undetermined
40SW802	Pre-Contact nondiagnostic open habitation	Recommended Not Eligible

*Bold sites are within/immediately adjacent to the potential CC site or transmission corridor

There are 58 previously identified historic architectural resources within a 0.5-mile search radius of CUF. These resources are summarized in Table 3.13-2 and depicted on Figure 3.13-1. One of these resources (SW-745), known as the Henry Hollister House (also known as the Jesse Brunson Place), is located immediately adjacent to the proposed CC plant. This property includes a ca. 1850 house, and historic cemetery, and late-nineteenth century cistern. The Henry Hollister House was listed in the NRHP in 1988 for its significance under Criterion B, for its association with a prominent ironmaster during the height of the Western Highland Rim iron industry, and under Criterion C as a good example of transitional Greek Revival/Italianate design. This property is associated with historic archaeological site 40SW723, which TVA and the Tennessee State Historic Preservation Officer (SHPO) have agreed is eligible for listing in the NRHP.

TVA contracted with TRC for a new NRHP assessment of the Henry Hollister House. Overall, the house is in a fair state of repair and maintenance, with no apparent structural problems. Based on this new assessment, despite the modifications TRC recommended that the house remains eligible for continued listing in the NRHP. TVA agreed with this assessment. The study included a GIS-based visual impact assessment, which took into consideration the proposed design and location of the CC plant and switchyard, and TVA's plans to clear vegetation in a 12-acre area between the proposed switchyard and the Henry Hollister House to prepare it for use as a construction support area. This analysis indicated that the CC plant and switchyard would be visible from some locations within the NRHP boundary of the Henry Hollister House. Trees on the Henry Hollister House property would provide some visual screening, and differences in elevation also would help block some of the proposed new facilities from view from the house. However, these factors would not be sufficient to reduce the visual effect to the level of non-adverse. At that time, TVA did not complete a GIS-based visual effects assessment for the proposed TL's that would cross the pasture near the Hollister House because the exact locations of structures had not yet been determined.

TRC followed up with an on-site field evaluation of the Hollister House, and in their August 2022 report (Karpynec 2022), recommended that the combined visual effects of the TLs and new facilities would result in an adverse visual effect on the Henry Hollister House. Based on these analyses, TVA found that the undertaking as currently proposed would result in an adverse effect on a NRHP-listed property. On September 6, 2022, TVA submitted a draft MOA to TN SHPO that outlines mitigation measures for adverse effects to the Henry Hollister House. On September 19, 2022, TVA submitted a response to requests for revision in a revised MOA to TN SHPO for signature; the final signed MOA was received from TN SHPO on September 22, 2022 (see Appendix M).

There are eight mapped previously surveyed areas within a 0.5-mile search radius of CUF. In correspondence dated December 20, 2021, the Tennessee Division of Archaeology (TDOA) noted that this list is not comprehensive and there may be negative finding reports nearby or references to additional publications on site records.

Table 3.13-2. Recorded Historic Architectural Resources on and Within 0.5 Mile of the CUF Reservation

Resource	Name	Construction Date	NRHP Status
SW-744	Dr.-Scott House	1898	Not Eligible, non-extant
SW-745	**Henry Hollister House**	**1781**	**Listed**
SW-747	Christian-School House	1870	Not Eligible, non-extant
SW-748	Gordon Schmid Smokehouse	1890	Not Eligible, non-extant
SW-749	Old Parchman Place	1881	Not Eligible
SW-750	Billy Ballard Place	1931	Not Eligible
SW-751	Old Ford Place	1881	Not Eligible
SW-753	Old Lowery Place	1881	Not Eligible
SW-754	Lowery Barn	1881	Not Eligible
SW-755	Old Lowery-Smokehouse	1881	Not Eligible
SW-758	The Old Holley House	1881	Not Eligible
SW-759	N/A	1930	Not Eligible
SW-761	N/A	Unknown	Not Eligible
SW-764	Charles Finch	1930	Not Eligible
SW-766	G.L. Landis	1930	Not Eligible
SW-767	G.L. Landis	1930	Not Eligible
SW-768	Cleo-Summers	1906	Not Eligible
SW-769	Old Wallace's Grocery	1916	Not Eligible
SW-770	Thomas and Bradford	1910	Not Eligible
SW-772	Old Christian-Store	1920	Not Eligible
SW-773	G.L. Landis House	1920	Not Eligible
SW-774	G.C. Bass House	1906	Not Eligible
SW-775	Henry Clay Thomas	1920	Not Eligible
SW-776	Herbert Parchman	1925	Not Eligible
SW-780	Church of Christ	1930	Not Eligible
SW-783	Old Crockarell House	1910	Not Eligible
SW-784	Workshop for C.C. Academy	1930	Not Eligible
SW-785	Jim McCracken	1900	Not Eligible
SW-786	Principal's House	1885	Not Eligible
SW-787	The Brocadice House	1925	Not Eligible

Resource	Name	Construction Date	NRHP Status
SW-788	DR-Scott Place	1911	Not Eligible
SW-789	Kate & G.L. Landis	1843	Not Eligible
SW-790	W.T. Thomas-School	1925	Not Eligible
SW-791	Old Ballard Place	1831	Not Eligible
SW-792	N/A	1841	Not Eligible
SW-793	N/A	1901	Not Eligible
SW-794	Jim Walden House	1900	Not Eligible
SW-795	Old DR-Scott Place	1881	Not Eligible
SW-796	Old S.E. Bradford Place	1881	Not Eligible
SW-797	N/A	Unknown	Not Eligible
SW-798	Gurley Wilson	1906	Not Eligible
SW-799	Old Williams-Bailey Place	1885	Not Eligible
SW-800	Reynolds Place	1905	Not Eligible
SW-801	Christian G. Schmid	1890	Not Eligible
SW-835	Richardson House	1930	Not Eligible
SW-838	N/A	1900	Not Eligible, non-extant
SW-839	N/A	1900	Undetermined
HO-HS-1	N/A	1948	Not Eligible
SW-BR-10	N/A	c. 1960	Not Eligible
SW-CE-2	N/A	Unknown	Not Eligible
SW-CH-7	N/A	c. 1910	Not Eligible
SW-HS-1	N/A	c. 1900	Not Eligible
SW-HS-4	N/A	c. 1960	Not Eligible
SW-HS-5	N/A	c. 1965	Not Eligible
SW-HS-6	N/A	c. 1930	Not Eligible
SW-HS-8	N/A	1948	Not Eligible
SW-HS-9	N/A	c. 1940	Not Eligible
	Cumberland Fossil Plant (CUF)	1973	Not Eligible

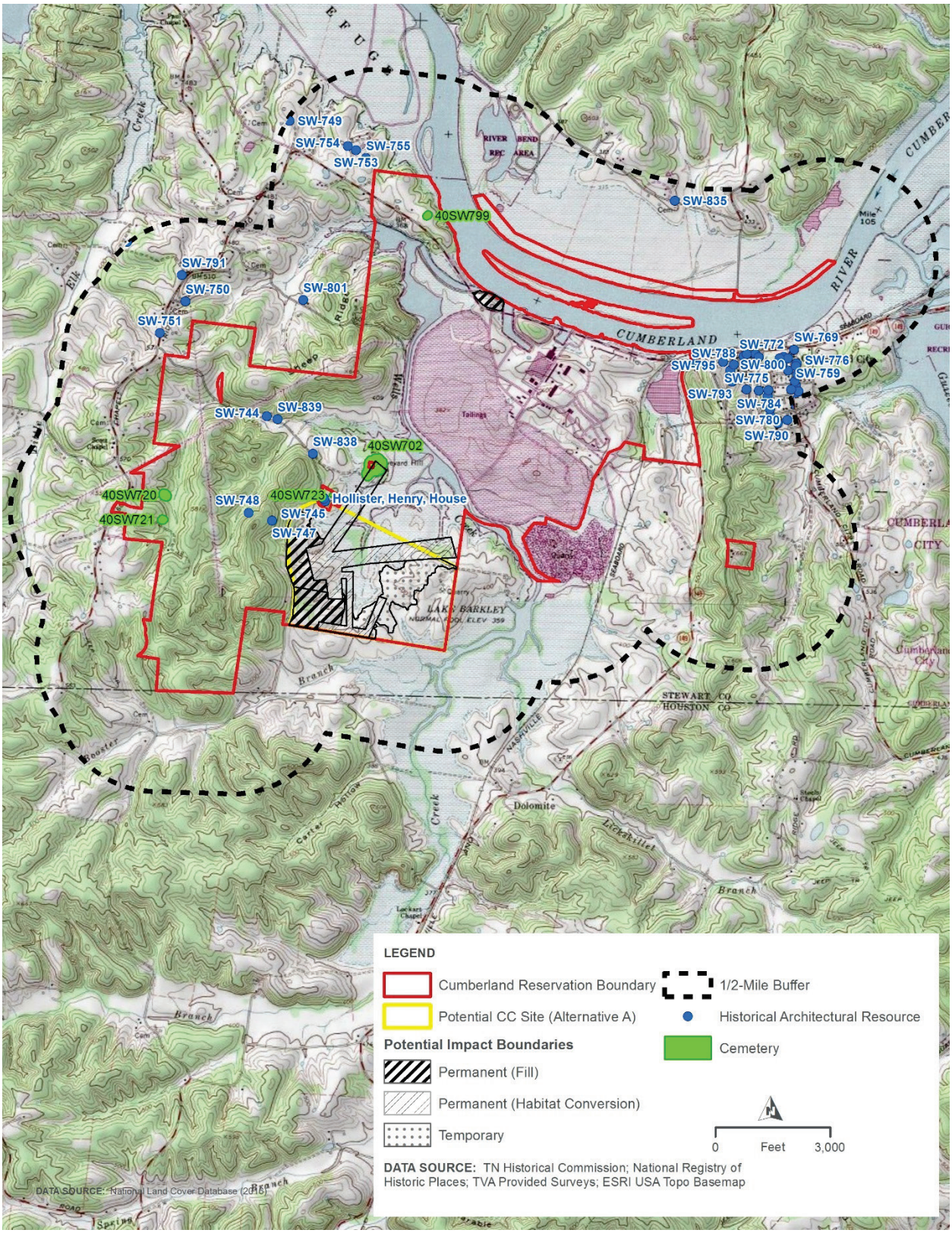

Figure 3.13-1. Previously Recorded Historic Architectural Resources Within 0.5 Mile of the CUF Reservation.

3.13.2.2. Alternative A

3.13.2.2.1. Construction and Operation of CC Plant, Transmission Lines, and Other Components at CUF Plant Site

As noted above in Table 3.13-2, there are 10 previously identified archaeological sites (40SW63, 40SW702, 40SW703, 40SW704, 40SW705, 40SW708, 40SW710, 40SW711, 40SW715, 40SW719, and 40SW723) located within or immediately adjacent to the proposed CC site and/or transmission line corridor. Three of these sites (Sites 40SW63, 40SW710, and 40SW723) are currently eligible or potentially eligible for listing in the NRHP. None of these sites are located within the CC footprint, as TVA has avoided physical effects to all of the archaeological sites.

- Site 40SW63, located within the potential CC site, consists of a Pre-Contact Early to Late Archaic and Early to Middle Woodland open habitation; the NRHP eligibility of this site is considered “potentially eligible”.
- Site 40SW710, located within the potential CC site, consists of a Pre-Contact Middle to Late Archaic open habitation, as well as a twentieth century domestic scatter; this site is potentially eligible for listing in the NRHP.
- Site 40SW723 is located within/immediately adjacent to the potential CC site. It is associated with the NRHP-listed Henry Hollister House and family cemetery and is eligible for listing in the NRHP.

3.13.2.2.2. Natural Gas Pipeline Corridor

In 2021, Stantec (Simpson et al. 2021) conducted a cultural resources survey of the proposed pipeline corridor. As a result of this survey and several other previous surveys, there are 24 recorded archaeological sites within the corridor outside of the CUF Reservation. These sites are summarized in Table 3.13-3. One of these sites (1647123-Moore Cemetery) is a historic cemetery. Three previously recorded sites (40DS113, 40HO83, and 40HO86) within the corridor were identified as potentially eligible for listing in the NRHP (Simpson et al. 2021). Site 40DS113 consists of an Early Archaic and Middle Woodland open habitation. Site 40HO83 consists of a Pre-Contact nondiagnostic open habitation. Site 40HO86 consists of an Early Archaic open habitation, as well as an historic rural domestic scatter. In addition, the pipeline corridor on TVA’s Cumberland Reservation crosses two previously recorded sites (40SW63 and 40SW710), both of which are potentially eligible for inclusion in the NRHP.

Table 3.13-3. Recorded Archaeological Sites Within the Proposed Natural Gas Pipeline Corridor Outside of the CUF Reservation.

Site Number	Site Type	NRHP Recommendation
40DS113	**Early Archaic and Middle Woodland open habitation**	**Potentially Eligible**
40DS114	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS115	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS116	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS117	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS118	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS119	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS120	Pre-Contact nondiagnostic open habitation	Not Eligible

Site Number	Site Type	NRHP Recommendation
40DS121	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS122	Middle Archaic open habitation; rural domestic scatter	Not Eligible
40DS123	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS124	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS125	Rural domestic scatter	Not Eligible
40DS126	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS127	Pre-Contact nondiagnostic open habitation	Not Eligible
40DS128	Pre-Contact nondiagnostic open habitation	Not Eligible
40HO11	Pre-Contact nondiagnostic open habitation	Not Eligible
40HO83	**Pre-Contact nondiagnostic open habitation**	**Potentially Eligible**
40HO85	Pre-Contact nondiagnostic open habitation	Unknown
40HO86	**Early Archaic open habitation; rural domestic scatter**	**Potentially Eligible**
40HO95	Pre-Contact nondiagnostic open habitation	Not Eligible
40HO96	Pre-Contact nondiagnostic open habitation	Not Eligible
40SW704	Pre-Contact nondiagnostic open habitation	Not Eligible
1647123	Moore Cemetery	Not Eligible

There are 29 previously recorded historic architectural resources within 0.5 mile of the corridor outside of the Cumberland Reservation. Two of these resources (HO-85 and DS-491) are within the pipeline corridor; both resources are not eligible for listing in the NRHP. These resources are summarized in Table 3.13-4 and depicted on Figure 3.13-2. One of the previously recorded resources (HO-20) within 0.5 mile of the corridor is eligible for listing in the NRHP. Resource HO-20 is the Buckeye Road Bridge, constructed in 1946.

The pipeline corridor is located within the federally designated Tennessee Civil War National Heritage Area, which encompasses the entire state of Tennessee. National Heritage Areas are designated by the U.S. Congress and “are places where historic, cultural, and natural resources combine to form cohesive, nationally important landscapes” (National Park Service 2022). The TCWNHA is the only NHA to encompass an entire state and is currently the only NHA designated within the state of Tennessee. The National Park Service (2019) lists 11 different sites across the state included within the TCWNHA, with the closest to the pipeline being the Fort Donelson National Battlefield located approximately 13 miles to the northwest in Dover. In addition to research at THC and TDOA, background research included searches of the Tennessee Civil War GIS Project (Tennessee State Library & Archives 2022) and the interactive map of Civil War Trails (2021) to identify any known Civil War sites within the vicinity of the pipeline. No Civil War sites were located within 0.5 mile of the pipeline corridor. The closest resource was a Civil War marker located approximately 1.3 miles southwest of the pipeline along Promise Land Road in Charlotte, Tennessee.

Table 3.13-4. Recorded Historic Architectural Resources Within 0.5 Mile of the Proposed Natural Gas Pipeline Corridor.

Resource	Name	Construction Date	NRHP
DS-362	Samuel T. Brumit House	1870	Not Eligible
DS-429	N/A	1920	Not Eligible
DS-478	N/A	Unknown	Not Eligible
DS-485	N /A	Unknown	Not Eligible
DS-486	N/A	Unknown	Not Eligible
DS-487	N/A	Unknown	Not Eligible
DS-488	N/A	Unknown	Not Eligible
DS-489	N/A	Unknown	Not Eligible
DS-490	N/A	Unknown	Not Eligible
DS-491	N/A	Unknown	Not Eligible
DS-492	N/A	Unknown	Not Eligible
DS-493	N/A	Unknown	Not Eligible
DS-494	N/A	Unknown	Not Eligible
DS-495	N/A	Unknown	Not Eligible
DS-496	N/A	Unknown	Not Eligible
DS-497	N/A	Unknown	Not Eligible
HO-1	Alfie Skelton Place	1853	Not Eligible
HO-112	Clements House	1900	Not Eligible
HO-17	Union-Stanfill Furnace	1853	Not Eligible
HO-20	**Buckeye Road Bridge**	**1946**	**Eligible**
HO-30	Carr House	1796	Not Eligible
HO-31	Abernathy House	1790	Not Eligible
HO-85	The Rye House	1904	Not Eligible
HO-190	Hudson House	1865	Not Eligible
HO-196	N/A	Unknown	Not Eligible
HO-197	N/A	Unknown	Not Eligible
HO-207	Ellis Mills Store	1890	Not Eligible
HO-211	N/A	1892	Not Eligible
SW-747	Gordon-Schmid	1870	Not Eligible

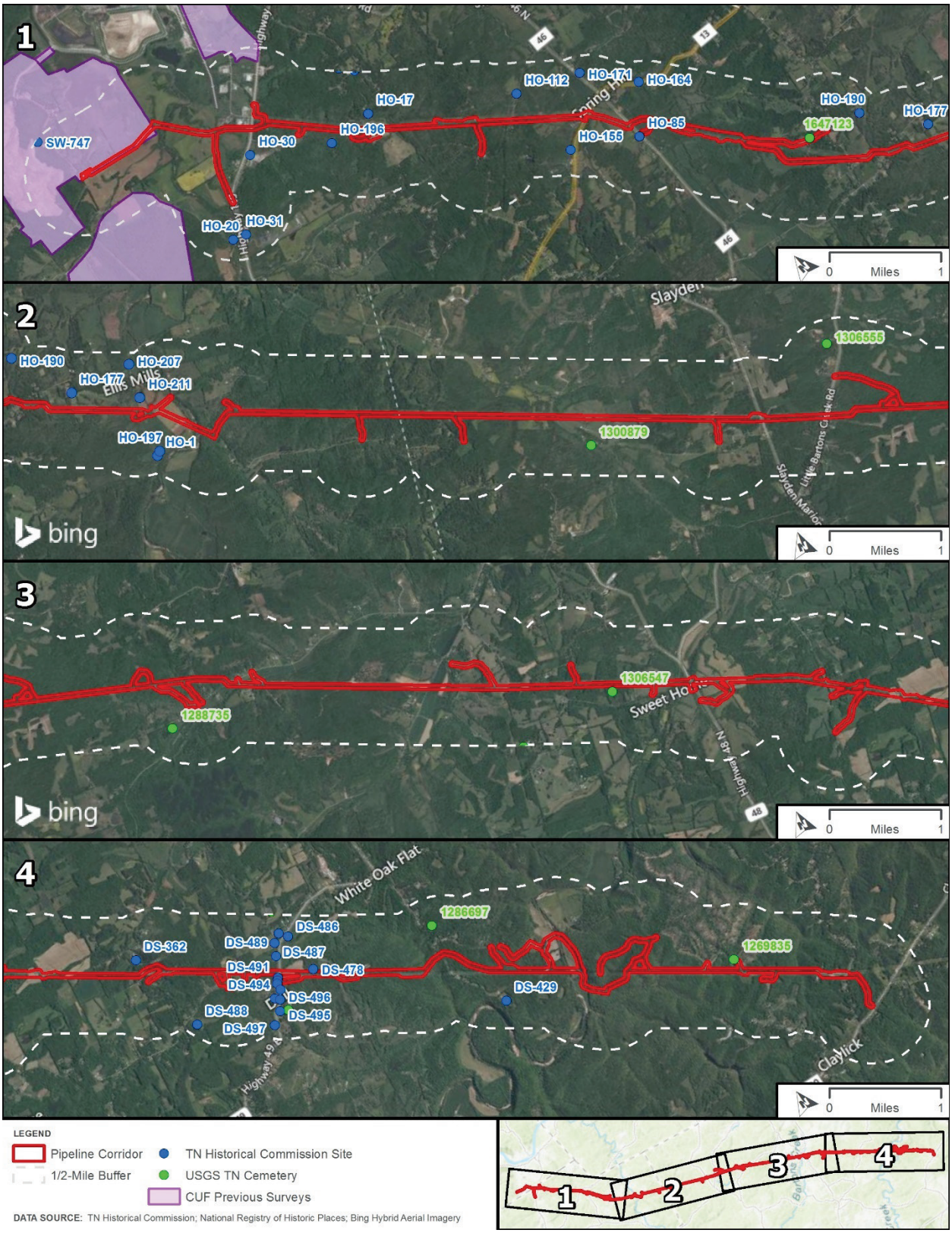

Figure 3.13-2. Previously Recorded Historic Architectural Resources Within 0.5 Mile of the Proposed Natural Gas Pipeline Corridor.

The historic architectural survey was conducted in accordance with the requirements of the THC as provided in *The Tennessee Historical and Architectural Survey Manual* (THC 2020). Historic properties with the potential to be considered eligible for listing on the NRHP were identified through archival research, visual inspection of the Project APE, and survey along accessible roads. All structures or historic resources constructed on or before 1975, 50 years prior to the Project's proposed in-service date, were documented and evaluated.

As a result of the historic architectural survey, 47 historic resources were recorded, including 27 in Dickson County and 20 in Houston County. No historic resources were recorded within Stewart County in association with the Project. The 47 resources include four cemeteries, two bridges, and 41 structures or structure groups. Of the 41 structures and structure groups, 27 are or include residential structures, 10 comprise only barns or other outbuildings, two are commercial structures, one is an industrial structure, and one is a water tower. Two of the historic resources, including one structure and one bridge, are recommended eligible for the NRHP, while the other 45 are recommended ineligible.

The structure considered eligible for the NRHP is the Herman Clark House / Brandon and Lindy Clark Farmstead, HS-32, in Houston County. This apparently abandoned farmhouse and outbuildings, constructed about 1880, are located at 984 Herman Clark Road approximately 340 ft. southwest of the proposed pipeline centerline. The Project would have no adverse effects on this historic property as no proposed aboveground facilities would be visible from this historic property and the permanent easement of the pipeline near this property is proposed to be co-located with the existing TVA ROW. HS-32 is greater than 300 ft. from the proposed Project pipeline centerline and is therefore considered to be too far to be affected by vibration, dust, or noise associated with Project construction. The bridge considered eligible for the NRHP is HS-47, a Louisville & Nashville Railroad Bridge in Houston County. This double box railroad bridge constructed of limestone exists along the former Louisville & Nashville Railroad at the crossing of Lickskillet Branch approximately 380 ft. southwest of the proposed pipeline centerline. The bridge lies approximately 50 ft. southeast of TAR AR-54. Given the sufficient distance from the proposed pipeline and workspace, the pipeline would have no adverse effects on this historic property. While the four identified historic cemeteries are recommended ineligible for the NRHP, they are protected under Tennessee state law. All four of these cemeteries are located completely outside the pipeline construction footprint and would not be affected by the project.

As stated in TGP's Resource Report 4 (TGP 2022d):

> The Phase I survey reports of work conducted between June 2021 and May 2022 and submitted in October 2021 (Simpson et al. 2021) and June 2022 (Ambrosino et al. 2022) and a previous survey report (Barrett and Holland 2013) included the majority of the [pipeline corridor] […]. The direct effects APE of the [pipeline] measures approximately 985.5 acres and approximately 944.7 acres of this total area was archaeologically surveyed during the recent Phase I investigation or was sufficiently covered by previous surveys. Approximately 40.8 acres of the [pipeline corridor] APE was not available due to lack of landowner access approval as of the July 19, 2022 TGP Resource Report 4.
>
> The Unanticipated Discoveries Plan (UDP) establishes procedures to be followed if previously unidentified cultural resources, such as archaeological sites, historic features, or human remains, are encountered during Project construction. Aspects of the plan, in particular procedures to be followed in the event of the inadvertent discovery of human remains, was submitted for review to the THC along with the

proposed Phase II survey work plans for the evaluation of Sites 40HO83, 40HO84, 40HO85, and 40DS113 on September 13, 2021. […] The SHPO reviewed the UDP on June 9, 2022 and concurred that the draft UDP meets its current standards and guidelines and adequately addresses unanticipated discoveries. TVA reviewed the UDP on June 14, 2022, and provided one suggested change to the draft UDP, which has been incorporated.

The draft Phase I cultural resources report that documents the results of the initial surveys for the [pipeline] was submitted to the THC on October 28, 2021 (Simpson et al. 2021). […] Comments provided by the THC following review of the Phase I report were received on November 3, 2021. The THC concurred with all recommendations in that report, except one recommendation regarding archaeological Site 40SW63 which TVA had previously determined potentially eligible and a candidate for Phase II testing. In an email dated December 3, 2021, the THC confirmed that Site 40SW63 had not been formally determined eligible for the NRHP and agreed that the recommended Phase II testing was appropriate. Also, in its November 3, 2021, letter, the THC indicated that sites 40HO87 and 40HO96 would require additional evaluations if there were any project changes to those locations. TGP has not made any project changes within the vicinity of either of those sites.

An addendum to the Phase I cultural resources surveys covering additional work performed between December 2021 and May 2022 was submitted to the THC on July 7, 2022 (Ambrosino et al. 2022). […] Comments provided by the THC following review of the Phase I addendum report were received on July 12, 2022. The THC concurred with the recommendations in that report.

Three Phase II archaeological investigation reports including work at five sites (40DS113, 40HO83, 40HO84, 40HO85, and 40HO86) were submitted to the THC on July 18, 2022 (Donaldson et al. 2022; Loughlin et al. 2022; Reaux et al. 2022). […] Comments were received from the THC regarding these reports were received on July 19, 2022. The THC concurred that sites 40DS113, 40HO83, and 40HO84 are not eligible for inclusion in the NRHP and that sites 40HO85 and 40HO86 are eligible for inclusion in the NRHP. The THC requested updated site forms for all sites and avoidance plans for sites 40HO85 and 40HO86.

Additional correspondence with the THC will be filed with the Commission following its receipt. Copies of any additional cultural resource reports, including the Phase II investigation report of investigations at sites 40SW63 and 40SW710, will be provided to the Commission when available.

[…] Through consultation with THC and TVA, TGP identified 18 [federally recognized Indian] tribes with a potential historic interest in the Project area. Notification letters regarding the Project were sent on September 13, 2021, to the offices of the [federally recognized Indian] tribes:

- Absentee-Shawnee Tribe of Indians of Oklahoma
- Alabama-Quassarte Tribal Town
- Catawba Indian Nation

- Cherokee Nation
- Chickasaw Nation
- Choctaw Nation of Oklahoma
- Coushatta Tribe of Louisiana
- Eastern Band of Cherokee Indians
- Eastern Shawnee Tribe of Oklahoma
- Jena Band of Choctaw Indians
- Kialegee Tribal Town
- Mississippi Band of Choctaw Indians
- Muscogee (Creek) Nation
- Osage Nation
- Quapaw Nation
- Shawnee Tribe
- Thlopthlocco Tribal Town
- United Keetoowah Band of Cherokee Indians of Oklahoma

The notification letters were sent to inform each [federally recognized Indian] tribe about the proposed [pipeline] and to request that they communicate any potential concerns they might have about possible impacts to traditional cultural properties and historic properties.

As of the [July 19, 2022 TGP Resource Report 4], responses have been received from five [federally recognized Indian] tribes. Any additional responses received from any of these federally recognized tribes will be filed with the [FERC] following their receipt.

[…] As of the [July 19, 2022 TGP Resource Report 4], the [FERC] has received two comments referencing cultural resources. In scoping comments from an individual, dated March 31, 2022, that were filed with the [FERC] in Docket No. PF22-2-000, the commenting party references a farm near the [pipeline] area that has been owned by his family for 133 years. The commenting party states that the fields associated with this farm are situated immediately adjacent to the south of the [pipeline] area at its western terminus. As seen on current aerial imagery, the extant buildings on the farm appear to lie between 0.30 and 0.37 mile south of the [pipeline] area, which is outside the Project APE. Since the farm is outside the Project's APE for direct effects, no portions of the farm were archaeologically surveyed during the Phase I cultural resource survey of the [pipeline].

In its April 4, 2022 scoping comments, the Southern Environmental Law Center raised several issues, including potential impacts of the [pipeline] to National Historic Trails and high potential historic sites associated with those trails, National Heritage Areas (including the TCWNHA), and properties listed on the NRHP (including the Henry Hollister House, the Richard C. Napier House, Promise Land

School, and the Nesbit Place Farm). There are two designated National Historic Trails in the state of Tennessee: Overmountain Victory Trail near the eastern boundary of the state and the Trail of Tears, the closest segment of which lies over 16 miles west of the [pipeline] area. The TCWNHA is the only NHA designated in the state of Tennessee and is defined as the boundaries of the state. The closest site listed by the National Park Service (2019) within the TCWNHA is the Fort Donelson National Battlefield located approximately 13 miles to the northwest of the [pipeline] area. Additional research indicates that there are no known Civil War sites or markers within 0.5 mile of the [pipeline] area. The four NRHP-listed resources identified in the scoping comment are all located more than 0.5 mile from the [pipeline] area (the Henry Hollister House is 0.64 to the north, the Nesbit Place Farm is 1.06 miles to the southwest, Promise Land School is 1.35 miles to the southwest, and the Richard C. Napier House is 1.48 miles to the southwest). Given the distance of these various resources from the Project area, the Project is expected to have no effect on them.

3.13.2.3. Alternative B

3.13.2.3.1. Johnsonville Reservation

There have been several previous cultural resources surveys on and near the Johnsonville Reservation, as depicted in Figure 3.13-3. In 2000, TRC Garrow Associates, Inc. (Ezell 2000) conducted an archaeological survey of two alternative ash disposal sites containing a total of 49 acres near the reservation. In 2001, TRC Garrow Associates, Inc. (McKee 2001) conducted an archaeological survey of a proposed generator plant on the reservation. The study area consisted of 40 acres, located to the south of the current proposed CT plant location. In 2018, Tennessee Valley Archaeological Research (Dison et al. 2018a) conducted an archaeological survey of the north railyard in connection with construction of a proposed water basin at the plant. The survey area contained approximately 21.3 acres, located adjacent to the proposed CT plant location. In 2018, Tennessee Valley Archaeological Research (Dison et al. 2018b) also surveyed two planned laydown yards associated with the proposed demolition of the Johnsonville Fossil Plant. These two survey parcels, located to the south of the proposed CT plant location, totaled 3.38 acres. TRC Environmental (Blankenship et al. 2019) conducted archaeological surveys of six separate areas throughout the Johnsonville Fossil Plant that covered a total of 171 acres; no archaeological resources were identified. Additionally, TVA has consulted with various agencies for several projects in this area. These include a proposed heat recovery steam generator, the Johnsonville Fossil Plant deconstruction, and four actions related to the plant deconstruction. These include closure of the JCT coal yard, closure of the JCT coal yard runoff pond, construction of a process water basin, and development of a borrow site.

There is one previously recorded archaeological site located within the existing JCT project area of the Johnsonville Reservation. Site 40HS277 was recorded by the Tennessee Division of Archaeology in 1994 based on information provided by a private individual who collected artifacts during JCT construction in the late 1940s. Site 40HS277 was reported as measuring 100 meters by 100 meters, and yielded a Clovis point. The site was located where the JCT condenser intake and water treatment plant were later constructed. Comparison of pre-1950 contour maps with the JCT grading plan and current setting indicates the site was destroyed by the construction of the condenser water intake. According to the site form, the site could not be relocated during a 2006 revisit. Based on this information, TVA has found that site 40HS277 is no longer extant; the TN SHPO agreed by letter dated February 14, 2018. TVA has previously determined that JCT is ineligible for the NRHP as a historic architectural resource, and SHPO has formally agreed with this determination on multiple occasions.

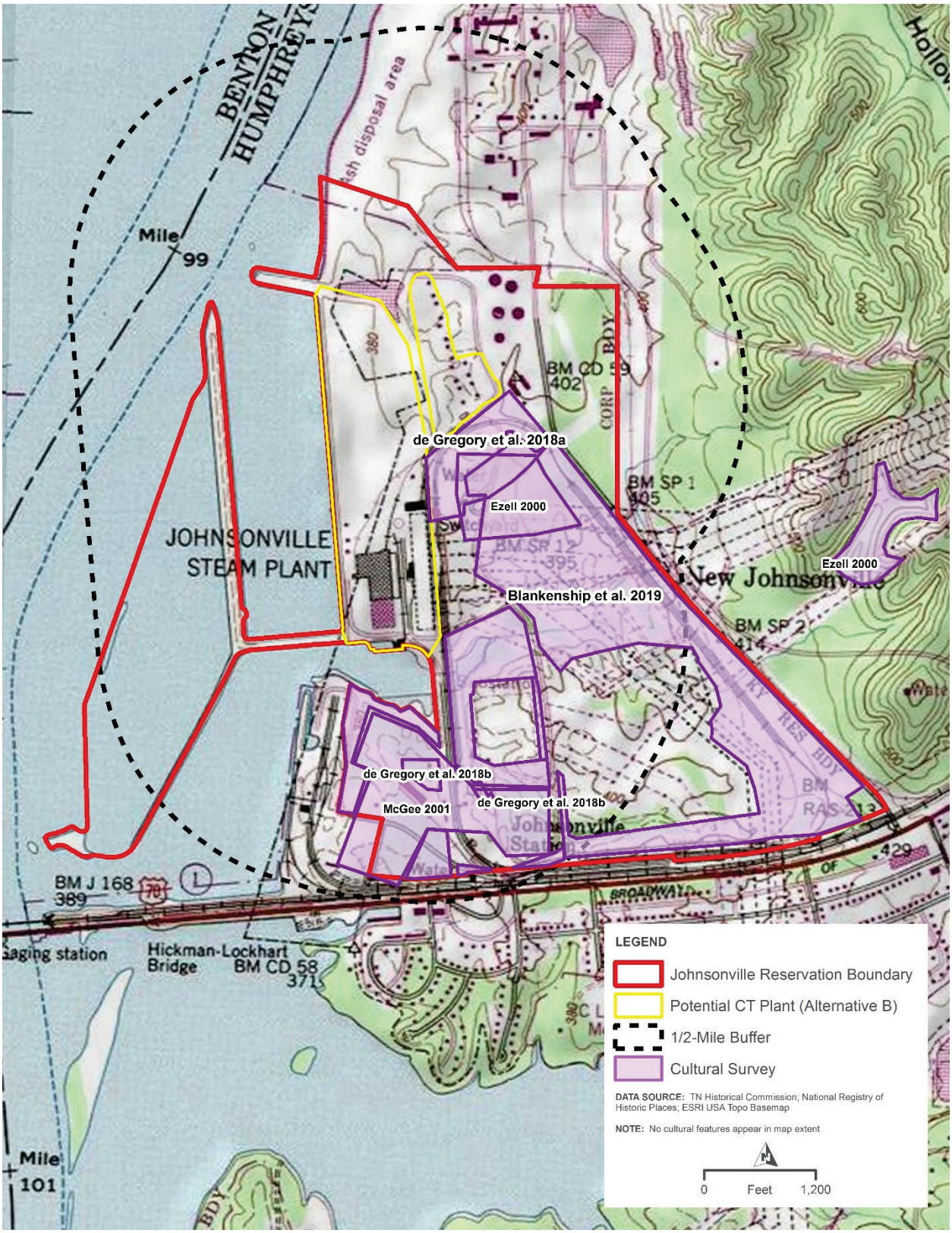

Figure 3.13-3. Locations of areas previously surveyed for cultural resources at the Johnsonville Reservation.

3.13.2.3.2. Gleason Reservation

There are no previously recorded archaeological resources within the potential plant location. There has been one previous cultural resources survey within this area. In 2008, TRC conducted a cultural resources survey of 20 acres for the location of new cooling towers at the Gleason reservation (McKee and Karpynec 2009). No archaeological were identified during the survey. The potential plant location is comprised of undeveloped agricultural fields and wooded areas. Therefore, TVA would conduct an archaeological survey of previously unsurveyed areas before implementing Alternative B and constructing the Gleason CT plant.

There are no previously recorded historic architectural resources within the potential plant location. TRC identified no historic architectural resources during their survey of the proposed 20-acre cooling tower site, or within 0.5 miles of this proposed development (McKee and Karpynec 2009). There is one previously recorded historic architectural resource (WK-970) within the 0.5 mile study buffer of the potential plant location (Figure 3.13-4). Resource WK-970 is the Featherston House, constructed in 1900. This resource is not eligible for listing in the NRHP. The location of this resource is shown in Figure 3.13-4. TVA would conduct an architectural survey of the viewshed surrounding the potential CT plant location, and complete all necessary consultations before implementing Alternative B and constructing the Gleason CT plant.

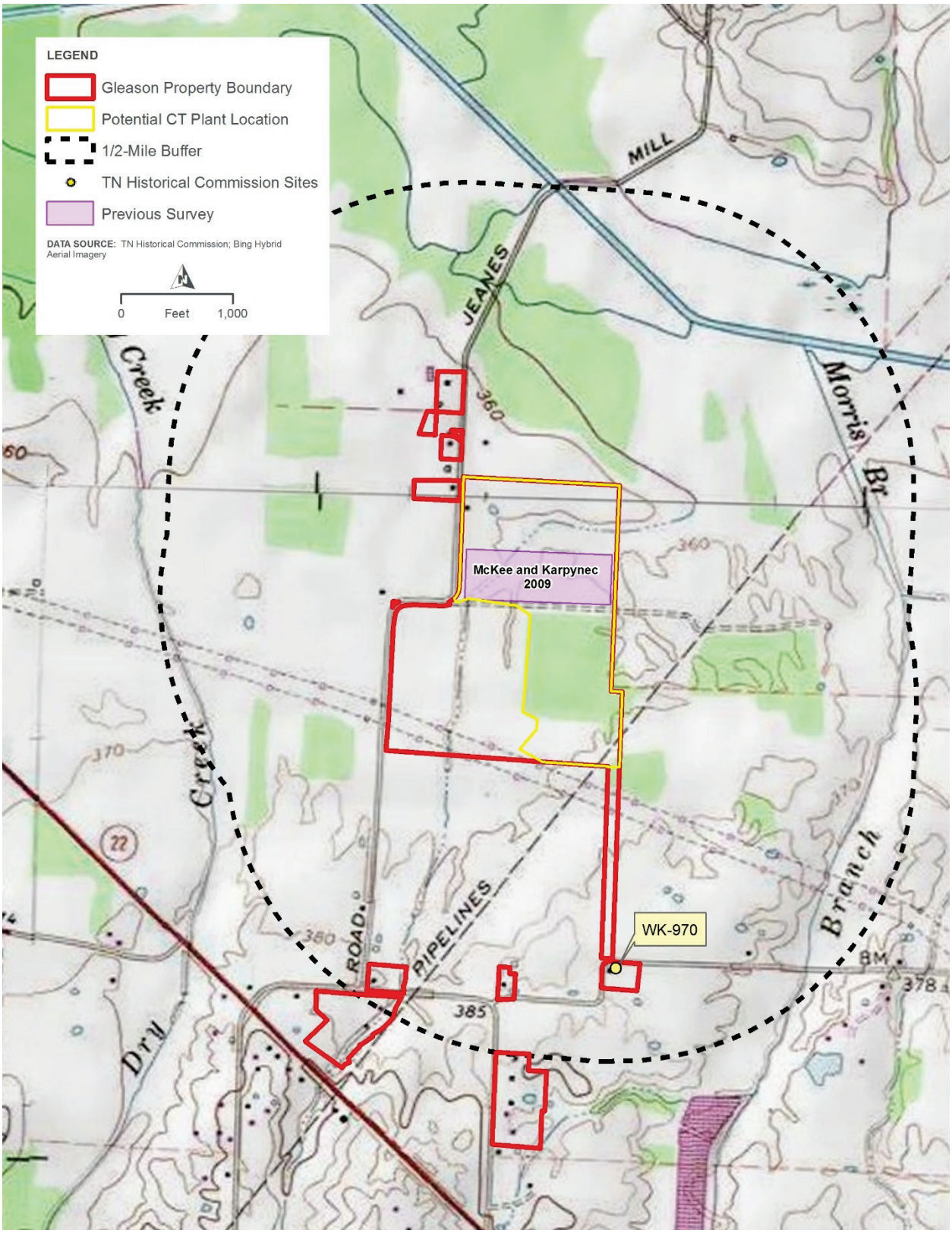

Figure 3.13-4. Previously Recorded Historic Architectural Resources and Previous Cultural Resources Surveys Within 0.5 Mile of the Gleason Reservation.

3.13.2.3.3. Transmission Corridor

There has been no historic property records research done for the proposed transmission line. As noted in Table 3.3-1, 14 percent of TVA new transmission line projects affect historic properties. The proposed 40-mile transmission line would require archaeological and architectural surveys and Section 106 consultation during future NEPA reviews.

3.13.2.4. Alternative C

TVA anticipates that a portion of the solar facilities proposed under Alternative C would be located in Middle Tennessee. As specific sites have not yet been determined for evaluation under this alternative, typical cultural resources effects of solar and storage construction and transmission projects have been listed under Section 3.2. A broad overview of archaeological resources, historic structures, and traditional cultural properties (TCPs) in the TVA region is presented below.

3.13.2.4.1. Archaeological Resources

Human occupation in the TVA region began at the end of the Ice Age with the Paleo-Indian Period (13,500 – 11,000 years before present, or “B.P.”). In the Tennessee Valley, prehistoric archaeological chronology is generally broken into four broad time periods: following the Paleo-Indian Period are the Archaic (11,000 – 3,000 B.P.), Woodland (3,000 – 1,100 B.P.), and Mississippian (1,100 – 500 B.P.) periods. Archaeological sites from all these periods, as well as from the more recent historic period, are very numerous throughout the TVA region. They occur on a variety of landforms and in a variety of environmental contexts. Sites are rarely found on steep slopes, with the exception of rock shelters, which have been used throughout the Pre-Contact and historic periods and often contain artifacts and features with value to archaeology and history. Areas affected by construction, mining, civil works projects and highways, for example, tend to lack significant archaeological resources due to modern ground disturbing activities.

The most reliable information about the locations of archaeological sites is produced during Phase I archaeological surveys conducted for compliance with Section 106 and Section 110. Numerous surveys have been conducted along reservoir shorelines, within reservoirs, and on power plant reservations. However, large areas remain that have not been surveyed. Some TVA transmission line corridors and many highway corridors have also been surveyed. But outside of TVA reservoirs and power plant reservations, the density of surveys is low and relatively little is known about archaeological site distributions.

The earliest documentation of archaeological research in the region dates back to the 19th century when entities such as the Smithsonian Institute and individuals such as Cyrus Thomas undertook some of the first archaeological excavations in America to document the history of Native Americans (Guthe 1952). TVA was a pioneer in conducting archaeological investigations during the construction of its dams and reservoirs in the 1930s and early 1940s (Olinger and Howard 2009). Since then, TVA has conducted numerous archaeological surveys associated with permitting actions, power plants, and transmission system construction and maintenance. These surveys, as well as other off-reservoir projects, have identified more than 2,000 sites, including over 250 within or in the immediate vicinity of TVA transmission line rights-of-way. A large proportion of these sites have not been evaluated for NRHP eligibility. The number of sites eligible or potentially eligible for listing on the NRHP is unknown.

Archaeological survey coverage and documentation in the region varies by state. Each state keeps records of archaeological resources in different formats. While digitization of this data is under way, no consistent database is available for determining the number of archaeological sites within the TVA region. Survey coverage on private land has been inconsistent and is

largely project-based rather than focusing on high probability areas, so data is unlikely to be representative of the total population of archaeological sites. Based on a search through TVA's data and reports of archaeological surveys on reservoirs, TVA estimates that over 11,000 archaeological sites have been recorded on TVA reservoir lands, including submerged lands. Significant archaeological excavations have occurred as a result of TVA and other federal projects and have yielded impressive information regarding the prehistoric and historic occupation of the Southeastern U.S. Notable recent excavations and related projects in the region include those associated with the Townsend, Tennessee highway expansion; Shiloh Mound on the Tennessee River in Hardin County, Tennessee; the Ravensford site in Swain County, North Carolina; and documentation of prehistoric cave art in Alabama and Tennessee.

3.13.2.4.2. Historic Structures

Historic architectural resources are found throughout the TVA region and can include houses, barns, public buildings, TVA facilities, and historic transmission lines. Many historic structures in the region have been either determined eligible for listing or have been listed in the NRHP. However, historic architectural surveys have been conducted in only a fraction of the land area within the region.

Over 5,000 historic structures have been inventoried in the vicinity of TVA reservoirs and power system facilities. Of those evaluated for NRHP eligibility, at least 85 are included in the NRHP and about 250 are considered eligible or potentially eligible for listing.

3.13.2.4.3. Traditional Cultural Properties

The TVA region is a diverse cultural landscape that held special meaning to its past inhabitants and to their descendants. Some of these places can be considered Traditional Cultural Properties (TCP). A TCP is defined as a property that is eligible for inclusion on the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community (Parker and King 1998). Similarly, a cultural landscape is defined as "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values" (Birnbaum 1994). TVA does not make public sensitive information regarding the location or other information regarding sacred sites or TCPs identified by consulting tribes. Some examples of TCPs within the study area include mound sites, segments of the Trail of Tears, and stacked stone features. The Trail of Tears consisted of many routes and sub-routes that were traveled by Native Americans during their removal from their ancestral homelands. Segments of the Trail of Tears cross TVA transmission lines at approximately 278 locations (TVA 2018a). Stacked stone features often appear as single or a group of cylindrically stacked limestone. The origin and purpose of these stone features is uncertain, but a resolution passed by the United South and Eastern Tribes, Inc. (USET), in 2007, recommended that all federal agencies involved in the Section 106 process consider stacked stone features that cannot be conclusively linked to a historic origin to be a TCP under NRHP Criterion A (USET 2007).

3.13.3. Environmental Consequences

3.13.3.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to operate and maintain CUF. TVA would implement all of the planned actions related to the current and future management and storage of CCRs. Under the scope of this EIS, no work would be conducted that would result in loss or disturbance of cultural resources beyond existing conditions. Therefore, no project-related environmental effects to cultural resources would occur under this alternative.

3.13.3.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

There are no archaeological sites located within the D4 LOD. There was one previously recorded archaeological resource reportedly located within the CUF. Site 40SW47 consists of a Pre-Contact Archaic village site located along the Cumberland River. The NRHP eligibility of this site is unknown. Site 40SW47 was initially identified in 1962; however, following subsequent archaeological surveys by DuVall (1995) and Barrett and Karpynec (2008) no evidence of site 40SW47 was observed. Based on these surveys, TVA determined that site 40SW47 has either been destroyed or was incorrectly mapped and is not located within the CUF. The SHPO did not disagree with this determination, nor did any of the consulted federally recognized Indian tribes.

In June 2022, TRC conducted an NRHP evaluation of CUF and recommended to TVA that it is not eligible for the NRHP due to the loss of integrity caused by modern alterations that have occurred to the facility within the past 50 years. The TN SHPO agreed that CUF was not eligible for the NRHP.

3.13.3.3. Alternative A

3.13.3.3.1. Construction and Operation of CC Plant, Transmission Lines, and Other Components at CUF Plant Site

Under Alternative A, TVA would construct and operate a CC plant, - a new switchyard at the CC plant and connect two 500-kV TLs to an existing TL ROW, all on the CUF Reservation. There are four previously identified archaeological sites (Sites 40SW63, 40SW702, 40SW710, and 40SW723) that have unknown NRHP eligibility or are currently eligible or potentially eligible for listing in the NRHP within the boundaries of the potential CC site and/or proposed transmission line corridor. Based on the current siting of the CC plant, effects to the archaeological sites would be avoided.

Site 40SW63 is located within the potential CC site; the NRHP eligibility of this site is considered potentially eligible, by consultation consensus between TVA and SHPO. Site 40SW710 is located within the CC site and the proposed natural gas pipeline lateral and is potentially eligible for listing in the NRHP. The project would avoid sites 40SW63 and 40SW710. Site 40SW702 is located partially within the proposed transmission line corridor; this site is potentially eligible for listing in the NRHP. Site 40SW702, the Graveyard Hill Cemetery, is also designated as Resource 1285974. The site also contains a Pre-Contact Late Archaic to Early Woodland open habitation component. No new transmission line structures would be placed within the boundaries of site 40SW702 and no vegetation clearing would be conducted inside the historic cemetery that is part of the site. Site 40SW723, the Henry Hollister House, is located within/adjacent to the potential CC site. Potential effects to the Henry Hollister House from construction-related truck traffic would be avoided or minimized by limiting routing construction vehicle traffic from the south along Old Scott Road.

There are three identified historic architectural resources within a ½ mile buffer of the proposed CC plant (Table 3.13-1) that are extant: SW-745, SW-801, and HS-01. Resource SW-745 is the NRHP-listed Hollister House. Resources SW-801 and HS-01 are ineligible for listing in the NRHP. Two previously inventoried historic architectural properties once located within a ½-mile buffer, SW-747 and SW-748, were previously removed and are no longer extant.

The NRHP-listed Henry Hollister House (SW-745) is located within the boundary of the potential CC site. Following a new NRHP assessment of the Henry Hollister House and supporting GIS-based visual impact assessment, TVA finds that the combined visual effects of the TLs and new

facilities would result in an adverse effect on an NRHP-listed property. The TN SHPO agreed with this assessment.

TVA considered design modifications that could minimize or avoid the adverse visual effects. However, given the size of the proposed facilities, the lack of other areas on the CUF Reservation suitable for building the facilities, and the need to avoid two large, potentially eligible archaeological sites (40SW63 and 40SW710), TVA was unable to identify practicable modifications to design for minimization or avoidance. Therefore, TVA and the SHPO executed a MOA stipulating the steps that TVA must complete in order to fulfill its obligations under Section 106 of the NHPA by mitigating the CC project's adverse effects to the Henry Hollister House. These measures will include: 1) installing a Tennessee Historical Commission historic marker presenting a brief narrative of the historic significance of the Hollister House; 2) plant a vegetative screening to minimize the visual effects on the Hollister House from TL and CC plant construction; 3) update the existing Hollister House NRHP nomination form; and 4) complete a study of the Graveyard Hill Cemetery. The final MOA was signed by SHPO on September 22, 2022, and is included in Appendix M. While the landfill construction associated with the CCR management activities at CUF directly impacted an archaeological site, TVA and SHPO agreed, in consultation, that effects are not anticipated as consultation and mitigation has been completed.

3.13.3.3.2. Construction and Operation of Natural Gas Pipeline

There are 24 previously recorded archaeological sites within the proposed pipeline corridor (Figure 3.13-4). One of these sites (1647123-Moore Cemetery) is an historic cemetery. Three of the previously recorded sites (40DS113, 40HO83, and 40HO86) within the corridor are potentially eligible for listing in the NRHP. TGP's final design for the pipeline would determine whether the Moore Cemetery would be avoided and left in place. During construction, safety fencing and "Do Not Enter" signs would be installed along the edge of the pipeline construction work area to notify construction crews of the cemeteries, and these features would be discussed during environmental training. Likewise, TGP's design would determine whether the three potentially eligible archaeological sites can be avoided. If these sites cannot be avoided, further archaeological testing investigations may be necessary to determine their NRHP eligibility.

There are 29 previously recorded historic architectural resources within 0.5 mile of the pipeline corridor. One of the previously recorded resources, the Buckeye Road Bridge, HO-20, is eligible for listing in the NRHP. Because the pipeline would be subsurface and given that the bridge is 0.4 miles from the pipeline corridor, the pipeline would have no effect on Resource HO-20.

The proposed pipeline corridor traverses potentially-eligible archaeological sites 40SW63 and 40SW710. The TN SHPO approved Phase II testing plans for each of the sites. However, TVA plans to avoid both of these archaeological sites.

As stated in TGP's Resource Report 4 (TGP 2022d):

> Of the potentially eligible sites identified above, one site (40HO87) has been avoided by the [pipeline] and TGP has undertaken Phase II site testing at the remaining seven sites. As of the date of [TGP's July 19, 2022 Resource Report 4], Phase II site testing has been completed at five of the sites (40DS113, 40HO83, 40HO84, 40HO85, and 40HO86) (Donaldson et al. 2022; Loughlin et al. 2022; Reaux et al. 2022). Following Phase II investigation, Sites 40DS113, 40HO83, and 40HO84 are now recommended ineligible for the NRHP. Sites 40HO85 and 40HO86 are both recommended eligible for the NRHP, however, the use of HDD

beneath these sites would result in no adverse effect to the sites. The SHPO concurred with the findings from the Phase II investigations completed pending avoidance plans for 40HO85 and 40HO86. Phase II work began at the remaining two sites (40SW63 and 40SW710) on May 17, 2022, but the results were not available as of the [July 19, 2022 Resource Report 4]. The Phase II report for these sites will be provided to the [FERC] when available, expected October 2022. If one or both of these sites are found to be eligible for the NRHP and considered to be adversely affected by the [pipeline], the sites would either be avoided by the pipeline or TGP would enter into consultation with the SHPO and TVA to mitigate adverse effects.

The regulations for implementing Section 106 of the NHPA require close coordination of the […] NEPA and NHPA processes (36 CFR §800.8), and expressly integrate consideration of cumulative concerns within the analysis of a proposed action's potential direct and indirect effects by defining "adverse effect" to include "reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative" (36 CFR §800.5(a)(1)).

[…] For the purposes of evaluating cumulative effects, the […] CIAA is defined as the APE of the proposed undertaking. The CIAA for cumulative impacts to cultural resources is the APE in which the impacts occur. In the case of the pipeline and associated equipment, the APE is defined as a 20-ft. (6-m) buffer around all proposed workspace for potential effects to archaeological resources and a 300-ft. (92-m) wide corridor that encompasses the pipeline centerline and potential workspaces for potential effects to aboveground historic architectural properties.

Activities identified within the cultural resources CIAA include past, present, and reasonably foreseeable actions. […] As of the TGP [July 19, 2022 Resource Report 4], no past or reasonably foreseeable future actions were identified within the cultural resources CIAA.

No past, present or reasonably foreseeable actions were identified that would impact cultural resources within the CIAA. The cultural resource surveys for the pipeline, including both background research and field assessments, have identified 11 potential historic properties within 0.5 mile of the pipeline. Four of these resources are outside the boundaries of the CIAA or otherwise would not be affected by the pipeline. These include archaeological Site 40DS22 (Cumberland Furnace) listed on the NRHP, archaeological Site 40HO87 considered potentially eligible for the NRHP, and historic resources HO-20 (Houston County-Buckeye Bridge) and HS-32 (Herman Clark House/Brandon and Lindy Clark Farmstead) considered eligible for the NRHP. Seven archaeological sites considered potentially eligible for the NRHP (Sites 40DS113, 40HO83, 40HO84, 40HO85, 40HO86, 40SW63, and 40SW710) are located within the CIAA and, as of the date of this report, have Phase II investigations pending. If, following the Phase II investigations, any of these sites are found to be eligible for the NRHP, they would either be avoided by the pipeline or TGP would enter into consultations with the SHPO, TVA, and federally recognized Indian tribes, as appropriate, to discuss options to mitigate adverse effects of the pipeline. As such, no cumulative impacts for cultural resources are anticipated.

TVA has evaluated and concurs with the findings presented in TGP's Resource Report 4 (TGP 2022d).

3.13.3.3.3. Summary of Alternative A

In sum, based on the current siting of the CC plant, physical effects to the archaeological sites would be avoided. The NRHP-listed Henry Hollister House is located within/adjacent to the potential CC site. TVA consulted with the SHPO and it was determined that the undertaking would result in an adverse visual effect to the Henry Hollister House. Under the conditions of a September 22, 2022 MOA between TVA and the TN SHPO, TVA will fulfill several stipulations to mitigate the adverse effects on the Henry Hollister House. Therefore, TVA has completed its Section 106 consultation for the undertaking and is committed to mitigating adverse effects to the single historic property (Henry Hollister House) that would be adversely affected. FERC is continuing consultation with the TN SHPO and federally recognized Indian tribes on its actions regarding specific effects to cultural resources along the pipeline corridor.

3.13.3.4. Alternative B

3.13.3.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Under Alternative B, TVA would construct a new CT plant on property located within the boundaries of the Johnsonville Reservation. The proposed CT plant would be built on previously developed portions of the reservation. There is one previously recorded archaeological site (Site 40HS277), though this site is no longer extant and is not within the proposed CT plant site.

There are no previously recorded historic architectural resources within the potential plant location, or within the 0.5-mile study buffer of the potential plant location. The proposed CT plant location is immediately adjacent to an area recently reviewed for the Johnsonville Aeroderivative Combustion Turbines Project (TVA 2022e). For that project, TVA stated that the entire viewshed has been previously surveyed and/or disturbed as part of other activities on the reservation and no eligible or listed historic structures were identified. Section 106 consultation with the SHPO was conducted on these previous projects and concurrence was received (Appendix M). Therefore, TVA considers the architectural APE to be lacking in historic properties. As such, in accordance with Section III. C of TVA's Section 106 PA, TVA has not completed a new archaeological or architectural survey of the APE.

To fulfill its obligations under Section 106 of the NHPA, TVA would consult with the TN SHPO on specific effects to cultural resources if Alternative B is selected for implementation. No cumulative effects to cultural resources would occur as no archaeological or architectural sites are within the adjacent Aeroderivative CT plant site.

3.13.3.4.2. Construction and Operation of CT Plant at Gleason Reservation

Under Alternative B, TVA would construct a new CT plant on a portion of the Gleason Reservation. There are no previously recorded archaeological resources on the proposed CT plant site. Twenty acres within this area have previously been subjected to a cultural resources survey (McKee and Karpynec 2009). The site is comprised of undeveloped agricultural fields and wooded areas.

There are no previously recorded historic architectural resources on or within ½ mile of the proposed CT plant site that are eligible for or listed in the NRHP. To fulfill its obligations under Section 106 of the NHPA, TVA would consult with the TN SHPO on specific effects to cultural resources if Alternative B proceeds. No cumulative effects to cultural resources would occur.

3.13.3.4.3. Transmission and Other Components

Under Alternative B, TVA would construct an approximately 40-mile, 500-kV TL in Weakley and Henry counties. The exact location of the transmission line is not known at this time and therefore TVA has not surveyed the project area for historic properties. TVA has compiled a list of typical effects associated with the construction and operation of transmission line facilities within the TVA region. As noted in Table 3.3-1, 14 percent of new transmission line projects affect historic properties. These effects generally consist of visual effects to historic architectural resources and physical effects to archaeological sites. TVA would seek to avoid any potential adverse effects on any NRHP-listed or eligible archaeological sites or historic architectural properties in the affected area. If adverse effects cannot be avoided, TVA would seek in consultation with SHPO and federally recognized Indian tribes, ways to avoid or minimize the adverse effects. If unavoidable, adverse visual effects to historic architectural resources could be mitigated through wooded buffers. Adverse direct effects to archaeological sites could be mitigated through Phase III archaeological investigations. Given the large area of the potential transmission line and other components, there is the possibility of multiple TCPs. To fulfill its obligations under Section 106 of the NHPA, TVA would consult with the TN SHPO and federally recognized Indian tribes on specific effects to cultural resources if Alternative B proceeds.

3.13.3.5. Alternative C

3.13.3.5.1. Construction and Operation of Solar and Storage Facilities

Under Alternative C, TVA would construct and operate 3,000 MW of solar and 1,700 MW of battery storage at various sites, mostly within Middle Tennessee, which would require 21,900 acres of solar and 640 acres of battery storage. Since the exact project locations of the solar and storage facilities are not known at this time, TVA has compiled a list of typical effects associated with the construction and operation of solar facilities within the TVA region. This list was compiled by reviewing the EAs and EISs for PV projects, ranging from community-scale to utility-scale, since 2014. A total of 31 projects were included in the review. Of these, approximately 3 percent have affected historic properties. These effects generally consist of visual effects to historic architectural resources and direct physical effects to archaeological sites. Based on the assumption of thirty 100 MW solar sites, approximately 1 site would result in effects to historic properties.

TVA would seek to avoid any potential adverse effects on any NRHP-listed or eligible archaeological sites or historic architectural properties in the affected area. If adverse effects cannot be avoided, TVA would seek in consultation with SHPO and federally recognized Indian tribes, ways to avoid or minimize the adverse effects. If unavoidable, adverse visual effects to historic architectural resources could be mitigated through wooded buffers. Adverse direct effects to archaeological sites could be mitigated through Phase III archaeological investigations. Given the large area of the potential solar developments, there is the possibility of multiple TCPs. To fulfill its obligations under Section 106 of the NHPA, TVA would consult with the TN SHPO on specific effects to cultural resources if Alternative C proceeds.

There is the potential for cumulative effects to cultural resources associated with the expansion of 10,000 MW of solar facilities as outlined in the 2019 IRP. Cumulative effects would be minimized through siting and avoidance of NRHP-listed or eligible sites, consultation with SHPO, and mitigation.

3.13.3.5.2. Transmission and Other Components

Under Alternative C, the new transmission line construction would be on and in the immediate vicinity of the solar and storage sites. The transmission line components would be designed to

avoid effects to historic properties. Possible effects to historic properties generally consist of visual effects to historic architectural resources and direct physical effects to archaeological sites. Adverse visual effects to historic architectural resources could be mitigated through wooded buffers. TVA would seek to avoid any potential adverse effects on any NRHP-listed or eligible archaeological sites or historic architectural properties in the affected area. If adverse effects cannot be avoided, TVA would seek in consultation with SHPO and federally recognized Indian tribes, ways to avoid or minimize the adverse effects. Adverse direct physical effects to archaeological sites could be mitigated through Phase III archaeological investigations. To fulfill its obligations under Section 106 of the NHPA, TVA would consult with the TN SHPO on specific effects to cultural resources if Alternative C proceeds.

There is the potential for cumulative effects to cultural resources associated with the expansion of 10,000 MW of solar facilities and their associated transmission lines as outlined in the 2019 IRP. Cumulative effects would be minimized through siting and avoidance of NRHP-listed or eligible sites, consultation with SHPO, and mitigation.

3.14. Solid and Hazardous Waste

3.14.1. Regulatory Framework

In general, hazardous materials include substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health or the environment when released into the environment. Hazardous materials are regulated under a variety of federal laws including Occupational Safety and Health Administration (OSHA) standards, Emergency Planning and Community Right to Know Act (EPCRA), the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation and Liability Act of 1980 and the Toxic Substances Control Act.

RCRA regulations define what constitutes a hazardous waste and establishes a “cradle to grave” system for management and disposal of hazardous wastes. Subtitle C of RCRA includes separate, less stringent regulations for certain potentially hazardous wastes. Used oil, for example, may be regulated as hazardous waste if it is disposed of, but it is separately regulated if it is recycled. Specific requirements are provided under RCRA for generators, transporters, processors, and burners of used oil that are recycled. Universal wastes are a subset of hazardous wastes that are widely generated. Universal wastes include batteries, lamps and high intensity lights, and mercury thermostats. Universal wastes may be managed in accordance with the RCRA requirements for hazardous wastes or by special, less stringent provisions.

Solid waste consists of a broad range of materials that include refuse, sanitary wastes, contaminated environmental media, scrap metals, nonhazardous wastewater treatment plant sludge, nonhazardous air pollution control wastes, various nonhazardous industrial waste, and other materials (solid, liquid, or contained gaseous substances). Solid waste is regulated by the USEPA and RCRA Subtitle D. Each state is required to ensure the federal regulations for solid waste are met and may implement more stringent requirements.

Special waste is a solid waste, other than a hazardous waste, that requires special handling and management to protect public health or the environment. In some states, special wastes may include sludges, bulky wastes, pesticide wastes, industrial wastes, combustion wastes, friable asbestos and certain hazardous wastes exempted from RCRA Subtitle C requirements. Any of these wastes, if generated, would be disposed as required by state and federal regulations. In

Tennessee, requirements for solid wastes are focused on solid waste processing and disposal under Rule 0400-11-.01.

Potential effects related to solid and hazardous waste of transmission line construction and operation were considered. Because of the nature of the action alternatives, any potential effects to solid and hazardous waste would be minor and insignificant. Thus, any further analysis of transmission lines and their effect on solid and hazardous waste resources was not deemed necessary.

3.14.2. Affected Environment

3.14.2.1. CUF Reservation and Transmission Corridor

3.14.2.1.1. Solid Waste

The primary solid wastes that result from the operation of CUF are CCRs in the form of ash and gypsum. Between 2016 and 2018, CUF produced an annual average of 431,565 tons of ash (fly and bottom ash) and 773,167 tons of gypsum. TVA has historically managed storage of CCR materials generated at CUF in a combination of onsite dry stacks, wet stacks and impoundments.

Fly ash and boiler slag are comprised of the noncombustible particles or components in coal. Both fly ash and bottom ash are composed primarily of silica, aluminum oxide and iron oxide. These waste streams also contain a variety of heavy metals at limited concentrations including arsenic, cadmium, chromium, copper, lead, mercury and selenium. In Tennessee, CCR are regulated as special wastes that require special approval for the wastes to be disposed of at a landfill specifically permitted to receive those types of wastes (Class I or II disposal facility).

Demolition and construction debris would be generated during the demolition of the metal buildings, footings, asphalt, etc. The facilities would be inspected for regulated materials (asbestos, lead paint, etc.) and would be properly abated prior to demolition. These wastes, if generated, would be disposed as required by state and federal regulations. Remaining demolition debris would be disposed offsite.

3.14.2.1.2. Hazardous Waste

Hazardous, non-radiological wastes typically produced by common facility operations include paint and paint solids, paint thinners, discarded out-of-date chemicals, parts washer liquids, sand blast grit, and chemical waste from cleaning operations. The amount of these wastes generated varies with the size and type of facility. Wastes regulated under TSCA that are typically encountered at TVA sites include PCBs, historically used in insulating fluids in electrical equipment.

CUF is considered a small quantity generator of hazardous waste by TDEC. In 2019, CUF shipped 2,371 pounds of hazardous waste (paint, paint chips/rags, obsolete aerosols, labpack materials, lithium batteries, liquids from x-ray developing machine, cleaners, and used PPE) to designated off-site facilities for disposal (TDEC 2019b).

3.14.2.1.3. Universal Waste

Universal wastes are a subset of hazardous wastes that are widely generated and can include batteries, pesticides, lamps and high intensity lights, and mercury thermostats. Universal wastes may be managed in accordance with the RCRA requirements for hazardous wastes or by special, less stringent provisions. CUF is considered a small quantity handler of universal waste that include batteries, lamps/bulbs, and mercury-containing equipment.

3.14.2.2. Alternative A

3.14.2.2.1. Proposed CC Plant Site

The proposed CC plant site is located on the CUF Reservation (Section 3.14.2.1). The site is agricultural fields and forested area that are not likely to contain or currently produce solid or hazardous waste.

3.14.2.2.2. Natural Gas Pipeline Corridor

Based on a review of the TDEC Division of Remediation database, permitted Tennessee landfill sites, solid waste processors, transfer or convenience centers, underground storage tank database. and the USEPA ECHO database (USEPA 2022), the following sites were identified within 0.5 miles of the pipeline corridor:

- TVA Cumberland Fossil Plant, located along the natural gas pipeline corridor, was listed in the Tennessee permitted landfill database as a Class II landfill. No violations were listed in association with the landfill.
- The Cumberland City convenience center, located adjacent to the pipeline corridor, was listed in the solid waste database. No violations were listed in association with the convenience center.
- Sudden Service 61 (a filling station), located 0.37 miles northeast (upgradient) of the pipeline, was listed in the UST database for 12 current USTs at the facility. No leaks or violations were listed in association with the USTs.

Based on the lack of violations or leaks, none of the above sites are considered a concern for Alternative A.

3.14.2.3. Alternative B

3.14.2.3.1. Johnsonville Reservation

Based on a review of the TDEC Division of Remediation database, permitted Tennessee landfill sites, solid waste processors, transfer or convenience centers, UST database. and the USEPA ECHO database (USEPA 2022), the following sites were identified on the Johnsonville Reservation:

- The Johnsonville Fossil Plant coal yard was listed in the remediation database as withdrawn.
- The New Johnsonville Fossil Plant was listed in the remediation database as closed.

The following sites were identified within 0.5 miles of the Johnsonville Reservation:

- E.I Dupont Landfill East Hollow, located north adjacent of the Johnsonville Reservation, was listed in the Tennessee permitted landfill database as a Class II landfill. No violations were listed in association with the landfill.
- E.I. Dupont Landfill North Hollow, located north adjacent of the Johnsonville Reservation, was listed in the Tennessee permitted landfill database as a Class II landfill. No violations were listed in association with the landfill.
- E.I. Dupont Landfill Ross Hollow, located north adjacent of the Johnsonville Reservation, was listed in the Tennessee permitted landfill database as a Class II landfill. No violations were listed in association with the landfill.

- The Dupont Johnsonville facility, previously located north adjacent of the Johnsonville Reservation, was listed in the remediation database as closed. No further information was provided.

Based on the lack of violations or leaks, none of the above sites are considered a concern for Alternative B.

3.14.2.3.2. Gleason Reservation

Based on a review of the TDEC Division of Remediation database, permitted Tennessee landfill sites, solid waste processors, transfer or convenience centers, underground storage tank database, and the EPA ECHO database, the following sites were identified within 0.5 miles of the Gleason Reservation:

- The Gleason generating facility, the currently operating CT plant on the reservation, was listed in the CAA, CWA, and RCRA databases within the USEPA ECHO database (USEPA 2022). No violations were identified in any of the databases.
- Chappell Mine #26, located 0.5 mile southwest (downgradient) of the Gleason Reservation, was listed in the CWA database within the USEPA ECHO database (USEPA 2022). No violations were identified.
- Gleason sewage treatment plant, located 0.5 miles northeast (downgradient) of the Gleason Reservation, was listed in the CWA database within the USEPA ECHO database (USEPA 2022). Quarterly violations were reported for exceedances of biological oxygen demand (BOD) or nitrogen concentrations since January 2019.

Based on the lack of violations the Gleason generating facility and Chappell Mine #26 are not considered a concern for Alternative B. Although the Gleason STP does have reported violations, it is not considered a concern because of the distance and gradient from the Gleason Reservation.

3.14.2.4. Alternative C

3.14.2.4.1. Middle Tennessee TVA Power Service Area

The affected environment of solid and hazardous waste in the Middle Tennessee region is based on general information in the IRP EIS (TVA 2019b). Coal-fueled generating plants produce large quantities of ash and other coal combustion solid wastes. Industries within Middle Tennessee also produce solid and hazardous waste that is tracked through various federal and state databases. The locations of proposed solar and storage facilities are not known; prior to development into a solar or storage facility, Phase I environmental site assessments would be conducted to identify potential records of environmental concern, including solid and hazardous wastes.

3.14.3. Environmental Consequences

3.14.3.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to operate CUF. TVA would implement all of the planned actions related to the current and future management and storage of CCRs at the fossil plants. As a result, existing solid and hazardous waste management would not change from continuing operations under this alternative. The generation and disposal of hazardous and universal wastes are not expected to change under the No Action Alternative.

3.14.3.2. Retirement, Decommissioning, Decontamination, and Deconstruction of CUF Plant

For all alternatives, the CUF plant would be retired, decommissioned, decontaminated, and deconstructed. The plant would be demolished to a depth of three feet below final grade. The solid and hazardous wastes listed below may be generated during demolition:

- Asbestos containing materials (ACM)
- Mercury in equipment switches and gauges
- Lead-containing materials including paint, coatings, roof vents, circuit boards, batteries, and cathode ray tubes
- Electronic wastes
- PCBs in replacement bushings and light ballasts
- Materials such as glaze, caulk, building siding, roofing materials, electric cable, cable trays
- Other construction wastes (e.g., concrete, scrap metal)
- Universal waste (fluorescent light bulbs, batteries, etc.)
- Off spec/surplus chemicals contained in aboveground storage tanks
- Containerized petroleum products or chemicals
- Refrigerants and ozone depleting substances
- Tritium exit signs
- Radioactive sources from equipment
- Various oils and fuels
- Antifreeze
- Batteries in bulk and associated fixtures including deep cycle series uninterruptible power supply batteries and lead batteries from emergency lighting
- Street lighting
- Batteries
- Creosote (in railroad ties) and
- Technology Enhanced Naturally Occurring Radioactive Materials.

A regulated material survey will be completed prior to demolition to estimate the materials and quantities for wastes generated. Additionally, all areas with stains or containing hazardous materials would be addressed prior to demolition as practical. All generated wastes would be handled in accordance with the TVA BMP procedures and local, state, and federal guidelines.

Direct effects would be minor due to the limited potential for hazardous waste to be discharged or released into the environment during D4 activities. Some wastes such as hazardous wastes, PCBs, ACMs, lead-based paints, and universal wastes which require special removal, handling, or disposal would be evaluated prior to demolition. These materials will be disposed of at a facility permitted to handle the waste streams. Non-hazardous or special waste will need to be transported to a landfill or other approved disposal facilities.

Possible short-term effects to the local environment are possible through the release of fugitive dust during demolition and while removing material to the landfill. If other projects in the area result in minor releases of fugitive dust or hazardous material, this may result in minor cumulative effects. Project and cumulative effects would be minimized through mitigation measures, including dust suppression and environmental controls. Due to the temporary nature of the operations and the use of permitted disposal facilities, along with trained and experienced contractors and personnel, environmental effects from waste handling and disposal are not anticipated. Degradation over time of the remaining structures and material that is incorporated into those remaining structures may cause minor indirect environmental effects.

3.14.3.2.1. Environmental Justice Considerations

Waste-related effects occurring as a result of CUF retirement and D4 activities would occur on or near the TVA-owned reservation or at selected waste facilities in the area. Most of the deconstruction materials would be transported by truck and train off site for recycling and disposal at approved landfills. As EJ populations are prominent in the CUF vicinity and the offsite waste facilities have the potential to be located in EJ areas, per the history of the siting of these type facilities (and the general assumptions that are made in evaluating EJ effects), amplified EJ effects are possible.

3.14.3.3. Alternative A

3.14.3.3.1. Construction and Operation of CC Plant at CUF

Under Alternative A, the proposed construction activities would result in a potential increase in generation of hazardous waste. Various hazardous wastes, such as waste paints, coating and adhesive wastes, and spent solvents, could be produced during construction. These wastes would be temporarily stored in properly managed hazardous waste storage areas on site. Appropriate spill prevention, containment, and disposal requirements for hazardous wastes would be implemented to protect construction and plant works, the public, and the environment. A permitted hazardous waste disposal facility would be used for ultimate disposal of the wastes. Once construction is completed, the generation of hazardous waste during operations would be similar to the current waste generation rates.

Any reportable spills and subsequent cleanup related to the Project would be addressed in accordance with the requirements outlined in the site spill plans. Designated contractor and subcontractor personnel would be responsible for daily inspection, cleanup, and proper labeling, storage, and disposal of all refuse and debris produced. Disposal containers such as dumpsters or roll-off containers would be obtained from a proper waste disposal contractor.

Construction of the CC Plant would generate typical construction debris and small volumes of solid waste:

- Paper, wood, glass and plastics would be generated from packing materials, waste lumber, insulation, and empty nonhazardous chemical containers.
- Scrap metal would result from welding, cutting, framing, and finishing operations, electrical wiring, disposal of packing materials, and empty nonhazardous chemical containers.

Construction and waste debris would be placed in containers or trucks and disposed of at a permitted offsite construction and demolition landfill. TVA would manage all solid wastes in accordance with applicable state regulations and TVA BMP procedures.

During construction, TVA would rely on the use of portlets and holding tanks at the construction trailer site. Waste would be pumped using an approved/licensed pump and haul vendor and sent to POTW. Once operational, the site facilities would connect to the existing online sewer system.

If CCR management projects in the area result in solid waste or hazardous material, this may result in minor cumulative effects. Cumulative effects would be minor as TVA will manage all hazardous and solid wastes in accordance with applicable federal and state regulations and TVA BMP procedures.

3.14.3.3.2. Construction and Operation of Natural Gas Pipeline

Under Alternative A, the proposed construction activities for the pipeline could result in the generation of solid and hazardous wastes. TGP conducted an analysis of the route using the USEPA NEPA ("NEPAssist") database (USEPA 2022) regarding the potential to encounter contaminated sediments within the project area. According to this assessment, the project is not within one mile of a Brownfield Site or Superfund Site (TGP 2022i). TGP is conducting a detailed analysis of potential solid and hazardous waste effects as part of the Environmental Report to be submitted with their certificate application that will be filed with the FERC for the proposed pipeline. If present, the gradient of the project could result in runoff into the pipeline trench and workspace areas. Should contaminated media (i.e., soil or groundwater) be encountered during construction, routine procedures would be followed to ensure work was stopped, access to the site was limited, and contaminated soil was contained and collected for sampling. Depending on the results of the analysis, a route variation to avoid the site would be considered or a site-specific plan for completing construction within the contaminated area would be prepared in accordance with applicable environmental regulations and in coordination with the appropriate agency. Any soil verified as contaminated would not be placed back into the trench unless approved by the appropriate agency. Decontamination could involve removing select regulated materials in a safe and practical manner in such a way that the pipeline is left in a status that does not present a hazard or risk to the environment or personnel (TGP 2022b).

Fueling of some construction vehicles typically occurs in the construction area. Other mobile equipment would return to the onsite laydown areas for refueling. An appropriate SPCC plan would be implemented by TGP to minimize the potential of a spill during construction and operation of the pipeline. Special procedures would be identified to minimize the potential for fuel spills, and spill control kits would be carried on all refueling vehicles for activities such as refueling, vehicle or equipment maintenance procedures, waste removal, and tank clean-out. A fuel truck may be stored on site for the duration of construction. Safety Data Sheets for all applicable materials present on site would be made readily available to onsite personnel (TGP 2022k).

Construction-related wastes may include skids, construction debris, timber mats, and used ECD materials will be removed and disposed of at an approved facility. No construction material will be buried in the ROW. All used lubricants and cleanup materials will be containerized and disposed of at an approved facility. All sandblasting materials will be contained and disposed of properly. Shipping manifests will be maintained that verify the proper labeling and shipping of all wastes to authorized off-site facilities. Once construction of the pipeline is completed, solid and hazardous wastes should not be generated.

If RFFAs in the area result in solid waste or hazardous material, this may result in minor cumulative effects. Cumulative effects would be minor as applicable federal and state regulations would be followed.

3.14.3.3.3. Summary of Alternative A

In sum, Alternative A would generate solid wastes typical of construction projects and is expected to generate at least some typical hazardous wastes such as waste paints, coating and adhesive wastes, and spent solvents. The project is not anticipated to result in the generation of hazardous wastes from the demolition or removal of any existing structures or subsurface materials, except for in the unlikely event of a spill during construction activities and its associated recovery response. Reportable project spills would be reported to state regulators and follow-up actions taken in accordance with the requirements of the site spill plans would be documented. All solid and hazardous waste generated during the construction and operation of the CC Plant and natural gas pipeline would be properly disposed of and documented.

3.14.3.3.4. Environmental Justice Considerations

Waste-related effects due to the CC plant and the pipeline activities would occur on or near a TVA-owned reservation or at selected waste facilities in the area that are yet to be identified. As the CC plant is located where EJ populations are prominent and the offsite waste facilities have the potential to be located in EJ areas, per the history of the siting of these type facilities (and the general assumptions that are made in evaluating EJ effects), amplified EJ effects are possible.

3.14.3.4. Alternative B

Construction of CT plants at Johnsonville and Gleason could result in a potential increase in generation of hazardous waste at each reservation. Solid and hazardous waste effects under Alternative B would be similar to those described for the CC plant construction under Alternative A. Various hazardous wastes, such as waste paints, coasting and adhesive wastes, and spent solvents, could be produced during construction. These wastes would be temporarily stored in properly managed hazardous waste storage areas on site. Appropriate spill prevention, containment, and disposal requirements for hazardous wastes would be implemented to protect construction and plant works, the public, and the environment. A permitted hazardous waste disposal facility would be used for ultimate disposal of the wastes. During normal operation, CT plants produce very small quantities of solid waste during normal operation; therefore, the generation of solid and hazardous waste during operations would be similar to the current waste generation rates at each reservation. Cumulative effects would be minor as TVA will manage all hazardous and solid wastes in accordance with applicable federal and state regulations and TVA BMP procedures.

3.14.3.4.1. Environmental Justice Considerations

Waste-related effects would be temporary or reduced in comparison to existing conditions, mitigated, and generally limited to the immediate TVA-owned reservations and transmission line corridor. These effects would likely not be amplified on EJ populations in the vicinity of the Gleason Reservation. However, since the census block groups immediately adjacent to JCT are qualifying low-income and minority populations, amplified effects to EJ populations are potential.

3.14.3.5. Alternative C

3.14.3.5.1. Construction and Operation of Solar and Storage Facilities

Construction of solar sites typically produce petroleum-based oils and fuels and generation of liquid and solid wastes in the form of used oil, construction debris, packing materials, and general construction wastes. During construction of the proposed solar facility, materials are typically stored on site in storage tanks, vessels, or other appropriate containers specifically designed for the characteristics of these materials. The storage facilities would include secondary containment in case of tank or vessel failure. Construction and decommissioning-related materials stored on site would primarily be liquids such as used oil, nitrogen, diesel fuel,

gasoline, hydraulic fluid, and other lubricants associated with construction equipment. Safety Data Sheets for all applicable materials present on site would be made readily available to onsite personnel.

Fueling of some construction vehicles typically occurs in the construction area. Other mobile equipment would return to the onsite laydown areas for refueling. Special procedures would be identified to minimize the potential for fuel spills, and spill control kits would be carried on all refueling vehicles for activities such as refueling, vehicle or equipment maintenance procedures, waste removal, and tank clean-out. A fuel truck may be stored on site for the duration of construction.

During operation, bulk chemicals would be stored in storage tanks; other chemicals would be stored in returnable delivery containers. Chemical storage areas would be designed to contain leaks and spills. The transport, storage, handling, and use of chemicals would be conducted in accordance with applicable laws, ordinances, regulations, and standards. While the various transformers would contain oil, there would be no separate oil or hydraulic fluid stored on site related to transformers.

Construction of solar sites also generates construction debris and general trash, including pallets and flattened cardboard module boxes. Universal wastes and unusable materials would be handled, stored, and managed in accordance with Tennessee Universal Waste requirements. Waste collection and disposal would be conducted in accordance with applicable regulatory requirements to minimize health and safety effects. To the extent possible, waste will be recycled. Materials that cannot be recycled would be disposed of at an approved facility to be determined by the designated contractor(s). No waste oil would be disposed of on the solar or storage facility sites.

If necessary, TVA, the facility developer, or the construction contractor would obtain a hazardous waste generator identification number from the state prior to generating any hazardous waste. Reportable project spills would be reported to state regulators and follow-up actions taken in accordance with the requirements of the site spill plans. A sampling and cleanup report would be prepared for the project site and sent to the state regulator to document each reportable spill and clean up.

Photovoltaic panels and other components of the solar sites have an estimated operational lifespan of up to 35 years and will eventually need to be replaced or decommissioned. The materials would be managed as potentially hazardous solid waste and may require characterization prior to recycling or disposal. If the panels are disposed, according to the EPA and TDEC, solar panels and other photovoltaic components are not considered universal waste and may not be managed as universal waste. Therefore, if disposed, the end-of-life management of photovoltaic components from the solar sites would require toxicity characteristic leaching procedure testing to determine if they are characteristic hazardous waste.

Although opportunities for recycling solar panels and lithium-ion batteries have been limited, some solar panel and battery manufacturers are developing panel-specific recycling programs or forming long-term recycling partnerships with developers. Therefore, opportunities for solar panel and battery recycling are expected to increase in the future.

Cumulative effects may occur with the additional 10,000 MW of solar facilities planned under the 2019 TVA IRP. Cumulative effects to solid and hazardous wastes would be minor as facilities

would be constructed and managed in accordance with established procedures and applicable regulations.

3.15. Safety

3.15.1. Regulatory Framework

Workplace health and safety regulations are designed to eliminate personal injuries and illnesses from occurring in the workplace. These laws may comprise both federal and state statutes. U.S. Department of Labor, OSHA is the main statute protecting the health and safety of workers in the workplaces. OSHA regulations are presented in Title 29 CFR Part 1910 (29 CFR 1919), OSHA Standards. A related statute, 29 CFR 1926, contains health and safety regulations specific to the construction industry. The Tennessee Department of Labor and Workforce Development has adopted federal OSHA standards contained in 29 CFR Parts 1910 and 1926 pursuant to Tennessee Code Annotated Section 50-3-201 (TVA 2016b). The other states in the TVA region have similar workplace safety regulatory programs.

3.15.2. Affected Environment

The routine operations and maintenance activities at the existing TVA facilities reflect a safety conscious culture. Activities are performed consistent with OSHA and state standards and requirements and specific TVA guidance. Personnel at TVA facilities are conscientious about health and safety having addressed and managed operations to reduce or eliminate occupational hazards through implementation of safety practices, training, and control measures.

TVA has a safety program in place to prevent worker injuries and accidents. The various prevention programs include but are not limited to the following:

- Operations and Maintenance Plans
- Hazard Communication
- Housekeeping
- Project Safety Plans
- Competent Person
- Ground Disturbance
- Lifting Operations
- Energy Isolation (Lockout/Tag out)
- Cutting, Burning, Welding and other “Hot Work”
- Incident Reporting and Investigations
- Personal Protective Equipment
- Hearing Conservation
- Employee Training
- Contractor Evaluation and Acceptance
- Emergency Spill/Release Plans
- Emergency Response Plan

The implementation of proper engineering and equipment design, administrative controls such as employee training and compliance with regulatory requirements related to Health and Safety, help ensure that the risks associated with work at TVA facilities remain low.

3.15.2.1. CUF Reservation

Public emergency services in the vicinity of the CUF Reservation include law enforcement services and fire protection services in Cumberland City, and urgent care clinics and a hospital in the city of Erin. The Stewart County Emergency Management Agency (EMA) has the responsibility and authority to coordinate with state and local agencies in the event of a release of hazardous materials (Tennessee EMA 2021).

The Stewart County Community Medical Center, located in Dover, approximately 11 miles (22 minutes) southwest of CUF, is the closest medical provider.

Law enforcement services in Cumberland City are provided by the Cumberland City Police Department, approximately one mile (four minutes) from the CUF. Stewart County law enforcement services are provided by the Stewart County Sheriff's Office in Dover, approximately 12 miles (25 minutes) from the CUF.

Fire protection services are provided by the Cumberland City Fire Department, located approximately two miles (five minutes) from the CUF.

3.15.2.2. Alternative A

3.15.2.2.1. Natural Gas Pipeline Corridor

TGP states in Resource Report 11 (TGP 2022k):

> Transportation of natural gas by pipeline involves risk to the public due to the potential for accidental release of natural gas. The greatest hazard is a fire that may result in the event of a major pipeline rupture or leak. Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiant, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death. Methane has an auto-ignition temperature of 1,000 degrees Fahrenheit and is flammable at concentrations between 5.0 percent and 15.0 percent in air. An unconfined mixture of methane and air is not explosive; however, it may ignite if there is an ignition source. A flammable concentration within an enclosed space in the presence of an ignition source can explode. Methane is buoyant at atmospheric temperatures and disperses rapidly in air.
>
> Pipelines and related facilities are designed, operated and maintained in accordance with […] USDOT Pipeline and Hazardous Material Safety Administration regulations at 49 CFR Part 192, "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards", to ensure both public safety and pipeline reliability and to minimize the opportunity for system failures. The USDOT's pipeline safety regulations in 49 CFR Part 192 are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. These regulations specify material selection and qualification, minimum design requirements, and protection from internal, external, and atmospheric corrosion. In addition, the safety standards in 49 CFR Part 192 require each operator to develop an emergency plan. Part of the emergency plan requires pipeline operators to work with local fire departments and other agencies

> to identify personnel to be contacted, equipment to be mobilized, and procedures to be performed to respond to a hazardous condition caused by the facility.
>
> Operators of natural gas transmission and gathering systems under the jurisdiction of the USDOT are required to report pipeline incidents to the Pipeline and Hazardous Materials Safety Administration Office of Pipeline Safety. […] TGP assumes that unplanned releases of gas from pipelines, as discussed in 49 CFR §191.3(1), as well as unplanned releases of gas from other components (e.g., compressor stations, meter stations), would be considered incidents. TGP has existing systems in place that provide notification of incidents in a timely manner. The proposed facilities would be incorporated into these systems following the commencement of operations.
>
> TGP also hosts training sessions periodically for emergency responders in the counties where facilities are located. TGP will continue to make contact with applicable emergency responders each year to ensure that the contact information is accurate, answer any questions, and offer follow-up training. In addition to these in-person meetings and contacts, TGP sends information to all public contacts located within approximately 1,000 feet of TGP facilities. Emergency responders located within this area would receive these mailings as well. During operation of the [pipeline facilities], the largest impact to public services would be associated with an emergency affecting the reliability or integrity of the natural gas facilities. The pipeline system includes design and equipment features, in addition to routine inspection and maintenance programs, that are designed to increase overall safety of the system.

Public emergency services in the area of the pipeline include urgent care clinics, hospitals, law enforcement services, and fire protection services. The Stewart, Houston, and Dickson County EMAs have the responsibility and authority to coordinate with state and local agencies in the event of a release of hazardous materials (Tennessee EMA 2021). The Houston County Community Hospital, located in Erin approximately 3.7 miles (7 minutes) southwest of the corridor is the closest medical provider along the corridor. The closest medical provider in Dickson County is Tristar Horizon Medical Center and in Stewart County is Stewart County Community Hospital. Law enforcement services and fire departments within 15 miles of the pipeline are listed below:

- Dickson County
  - City of Dickson Fire Department Station 1
  - City of Dickson Fire Department Station 2
  - Sylvia-Yellow Creek Fire Department
  - Tennessee City Volunteer Fire Department
  - Dickson Police Department
  - City of Dickson Police Department
  - Burns Police Department
  - Dickson County Sheriff's Office
  - White Bluff Police Department
  - Tennessee Highway Patrol

- Houston County
    - Houston County Fire Department
    - Houston County Fire Department
    - Houston County Fire Department Station 2
    - Tennessee Ridge Fire Department
    - City of Erin Fire Department
    - Erin City Police Department
    - Houston County Sheriff
- Stewart County
    - Dover Fire Department
    - Indian Mound Volunteer Fire Department
    - Stewart County Fire Rescue
    - Stewart County Fire and Rescue – Station 13
    - Stewart County Volunteer Fire Service Station 2- Red Top
    - Stewart County Volunteer Fire Service Station 4 – Taylors Chapel
    - Stewart County Volunteer Fire Service Station 5 – Hopewell
    - Stewart County Volunteer Fire Service Station 6 – Cumberland City
    - Stewart County Volunteer Fire Service Station 10 – Indian Mound
    - Stewart County Volunteer Fire Service Station 11 – Loon Bay
    - Stewart County Volunteer Fire Service Station 12 – Bear Springs
    - Cumberland City Police Department
    - Stewart County Sheriff
    - Dover Police Department

3.15.2.3. Alternative B

3.15.2.3.1. Johnsonville Reservation

Public emergency services in the vicinity of the Johnsonville Reservation include law enforcement services, a medical center, and fire protection services in New Johnsonville, and urgent care clinics and a hospital in the city of Camden. The Humphreys County EMA has the responsibility and authority to coordinate with state and local agencies in the event of a release of hazardous materials (Tennessee EMA 2021).

The New Johnsonville Family Health Center, located in New Johnsonville, approximately one mile (five minutes) southeast of the plant site, is the closest medical provider to the site. Law enforcement services in New Johnsonville are provided by the New Johnsonville Police Department, approximately one mile (three minutes) from the JCT. Humphreys County law enforcement services are provided by the Humphreys County Sheriff's Office in Waverly, approximately 12 miles (17 minutes) from the JCT. Fire protection services are provided by the New Johnsonville Fire Department, located approximately one mile (three minutes) from the JCT.

3.15.2.3.2. Gleason Reservation

Public emergency services in the vicinity of the Gleason Reservation include law enforcement services and fire protection services in the town of Gleason, walk-in clinics in the town of Dresden, and a hospital in the city of McKenzie. The Weakley County EMA has the responsibility and authority to coordinate with state and local agencies in the event of a release of hazardous materials (Tennessee EMA 2021).

The Gleason Clinic, approximately two miles (five minutes) south of the Gleason site, is the closest medical provider to the site. Law enforcement services in Gleason are provided by the Gleason Police Department, approximately three miles (six minutes) from the Gleason site. Weakley County law enforcement services are provided by the Weakley County Sheriff's Office in Dresden, approximately six miles (six minutes) from the site. Fire protection services are provided by the Gleason Fire Department, located approximately three miles (five minutes) from the site.

3.15.2.3.3. Transmission Corridors

Public emergency services in the proposed TL corridor area include urgent care clinics, hospitals, law enforcement services, and fire protection services. The Weakley and Henry County EMAs have the responsibility and authority to coordinate with state and local agencies in the event of a release of hazardous materials (Tennessee EMA 2021).

The West Tennessee Healthcare Volunteer Hospital Emergency Room, located in Martin, approximately 4.8 miles (eight minutes) north of the corridor, is the closest medical provider near the corridor. Law enforcement services are provided by the Weakley County Sheriff's Office in Dresden (3.7 miles south, seven minutes) and the Henry County Sheriff's Office (7.4 miles south, 11 minutes) in Paris. Fire protection services are provided by the City of Martin Fire-Rescue Station 1, located approximately 5.2 miles (nine minutes) from the corridor. These are the closest emergency services to a specific point on the corridor. Distances and travel times will vary at different points on the corridor.

3.15.2.4. Alternative C

3.15.2.4.1. Middle Tennessee TVA Power Service Area

TVA anticipates that a portion of the solar and storage facilities required for Alternative C would be located in the Middle Tennessee region. During construction, workers would have an increased safety risk typical for other construction activities. Particular caution would be taken when handling solar panels due to the potential for electric shock. The standard practice is for contractors to establish and maintain health and safety plans in compliance with OSHA regulations. See Section 2.3.1 for more details on standard BMPs.

3.15.3. Environmental Consequences

3.15.3.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to operate and maintain the CUF plant and adhere to all applicable safety standards. The continued combustion of coal and associated wastes would incur risks to worker safety. No other project-related effects on public health and safety would result.

3.15.3.2. All Action Alternatives

TVA's Standard Programs and Processes related to safety would be strictly adhered to during implementation of all the action alternatives. The safety programs and processes are designed to identify actions required for the control of hazards in all activities, operations, and programs. They also establish responsibilities for implementing Section 19 of the Occupational Safety and

Health Act of 1970. TVA and its contractors are required to comply with Occupational Safety and Health regulations and follow a Site-Specific Safety & Health Plan.

Potential public health and safety hazards could result from increased traffic on roadways as a result of all the action alternatives. Residential and other human use areas along roadways used by construction traffic to access the site would experience increased commercial and industrial traffic. Awareness of these residences and establishment of traffic procedures to minimize potential safety concerns would be addressed in the health and safety plans followed by construction contractor(s).

3.15.3.3. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Under all Action Alternatives, TVA would retire, decommission, deactivate, decontaminate, and deconstruct the CUF plant. Primary operational measures that would be discontinued due to the plant retirement include daily coal barge operations, coal pile management, pumping and use of water from the Cumberland River for the coal plant, and thermal discharges back into the Cumberland River. The combustion of coal for the production of power would cease as would generation of wastes associated with such power production, thereby eliminating any risks resulting from proximity to coal combustion for workers onsite.

During D4 activities, workers would have an increased safety risk. However, because D4 work has known hazards, the standard practice is for contractors to establish and maintain health and safety plans in compliance with OSHA regulations. Health and safety plans emphasize BMPs for site safety management to minimize potential risks to workers. Examples of BMPs include employee safety orientations; establishment of work procedures and programs for site activities; use of equipment guards, emergency shutdown procedures, lockout procedures, site housekeeping, and PPE; regular safety inspections; and plans and procedures to identify and resolve hazards. Asbestos-containing materials in building structures and systems would be remediated as necessary to be protective of environment and worker health and safety, but full abatement would not occur until demolition activities are initiated.

A spill plan would be implemented to minimize the potential of a spill during the drainage and disposal of oil and fluids and to instruct on-site workers on how to contain and clean up any potential spills. Decontamination would involve removing select regulated materials in a safe and practical manner in such a way that the plant is left in a status that does not present a hazard or risk to the environment or personnel. Limited contamination work undertaken at the fossil plants may include abatement and disposal of regulated materials, which include but are not limited to PCB equipment, asbestos, hazardous waste, and solid waste. The perimeter of each grouping of project elements would remain securely fenced during demolition and decontamination, and access gates would normally remain locked. General public health and safety would not be at risk in the event of an accidental spill on site. Emergency response would be provided by the local, regional, and state law enforcement, fire, and emergency responders.

Since explosive demolition would be conducted under tight security, the danger to the public from this activity would likely be very low. Explosives would be managed under the direction of a licensed blaster. Security would be a very important component of this event to eliminate as much as possible any threats to public health or safety. Once explosives arrive onsite, 24-hour security would be provided to monitor the explosives. Detailed security plans would be developed and provided to area emergency response agencies. Security details, including any information about the transport and storage of explosives, would be limited to authorized personnel only. Site security on the day of the event would be strictly enforced, and trespassing

would not be tolerated. Notifications to the public would be issued prior to the use of explosives for demolition. Health and safety hazards could result from premature detonation or premature collapse of structures during demolition if explosives are used. These risks are reduced if mechanical demolition is utilized, though precautions would still be implemented. Overall, effects to public health and safety in association with implementation of the Proposed Action would be considered temporary and minor.

During demolition and materials removal, truck traffic of other projects on the CUF Reservation and CCR Management activities would add to the traffic. This could result in cumulative safety effects as a result of the cumulative traffic effects from nearby projects. Effects would be anticipated to be temporary and minor and would affect primarily the truck drivers and construction personnel. Controls would be needed to ensure truck traffic is coordinated and safe. With proper planning, adherence to OSHA regulations and health and safety plans, and implementation of BMPs, cumulative effects from the project in relation to public health and safety would not occur.

3.15.3.3.1. Environmental Justice Considerations

Safety-related effects that would occur from CUF coal facility retirement and D4 activities would likely be heightened on the CUF Reservation, where no populations are present, and in the vicinity, where high traffic concentration would occur. Given their proximity to the D4 activity areas and associated traffic concentrations, EJ populations have the potential to experience amplified safety effects from CUF retirement.

3.15.3.4. Alternative A

3.15.3.4.1. Construction and Operation of CC Plant at CUF

Under Alternative A, TVA would retire the CUF, demolish the units, and construct and operate a CC plant on the CUF Reservation. TVA would also construct a new switchyard at the CC plant and connect to the existing 500-kV TLs. During construction, workers would have an increased safety risk. See Section 2.3.1 Standard Practices and Routine Measures for additional details on standard BMPs.

The CC plant would require minor and temporary movement of fuel gas and oil. An SPCC plan would be implemented to minimize the potential of a spill during construction and operation and to instruct on-site workers on how to contain and clean up any spills. The perimeter of each grouping of Project elements would remain securely fenced during construction and operation, and access gates would normally remain locked. Security fencing around the site boundary would be installed during construction. Once the plant is operational, permanent security fencing would be installed. General public health and safety would not be at risk in the event of an accidental spill on site. Emergency response would be provided by the local, regional, and state law enforcement, fire, and emergency responders.

During construction of the CC plant, truck traffic of other projects on the CUF Reservation and CCR Management activities would add to the traffic. This could result in cumulative safety effects as a result of the cumulative traffic effects from nearby projects. Effects would be anticipated to be temporary and minor and would affect primarily the truck drivers and construction personnel. Controls would be needed to ensure truck traffic is coordinated and safe.

The public health and safety effects of air quality from coal plant operations would be reduced, as the CC Plant emit fewer air pollutants. The CC plant would also use an SCR system located within the HRSG for additional NO_x reduction. As 19.5% aqueous ammonia would be used

rather than anhydrous (gaseous) ammonia used by the coal plant, an onsite ammonia receiving and storage facility would not be required. See the Air Quality Section 3.7 for more information.

TLs, like all other types of electrical wiring, generate both electric and magnetic fields (EMFs). The voltage on the conductors of a TL generates an electric field that occupies the space between the conductors and other conducting objects such as the ground, TL structures, or vegetation. A magnetic field is generated by the current (i.e., the movement of electrons) in the conductors. The strength of the magnetic field depends on the current, the design of the line, and the distance from the line. Most of this energy is dissipated on the ROW, and the residual very low amount is reduced to background levels as distance from the line increases.

Magnetic fields can induce currents in conducting objects. Electric fields can create static charges in ungrounded, conducting materials. The strength of the induced current or charge under a TL varies with: (1) the strength of the electric or magnetic field, (2) the size and shape of the conducting object, and (3) whether the conducting object is grounded. Induced currents and charges can cause shocks under certain conditions by making contact with objects in an electric or magnetic field. The existing offsite TLs have been designed to minimize the potential for such shocks. This is done, in part, by maintaining sufficient clearance between the conductors and objects on the ground. Stationary conducting objects, such as metal fences, pipelines, and highway guardrails that are near enough to the TL to develop a charge (typically these are objects located within the ROW) would be grounded by TVA to prevent them from being a source of shocks.

TL construction and operation requires a high level of safety risk management due to the dangers present when working near high-voltage equipment. Overall, effects to public health and safety in association with the transmission system components on the CUF Reservation would be considered temporary and minor. With proper planning, adherence to OSHA regulations and health and safety plans, and implementation of BMPs, cumulative effects from the project in relation to public health and safety would not occur.

3.15.3.4.2. Construction and Operation of Natural Gas Pipeline

The construction and operation of a new CC plant requires construction of approximately 32 miles of new natural gas pipeline and gas system infrastructure.

Construction of the pipeline may result in a temporary increased demand on public services. Potential temporary impacts on services may include traffic-related incidents, medical emergencies, and issuances of permits for vehicles subject to load and width restrictions.

During construction, workers would have an increased safety risk. However, because construction work has known hazards, the standard practice is for contractors to establish and maintain health and safety plans in compliance with OSHA regulations.

During construction, emergency vehicles access would be maintained by minimizing the duration of road and driveway outages and keeping steel plates at the site of construction. Should emergency vehicles need to travel through the work area, the steel plates would be quickly installed over the open trench, thus allowing vehicles to pass.

An appropriate SPCC plan would be implemented by TGP to minimize the potential of a spill during construction and operation of the pipeline. Decontamination could involve removing select regulated materials in a safe and practical manner in such a way that the pipeline is left in a status that does not present a hazard or risk to the environment or personnel.

Natural gas transmission pipeline incidents are rare and their consequences vary. For the 10-year period from 2012 through 2021, 1,155 incidents were reported by natural gas transmission pipeline operators in the United States. In 2021, there were 99 pipeline incidents that resulted in four injuries and four fatalities (USDOT 2022). Using the annual average for incidents (114) from 2012 through 2021 and the average miles of gas transmission pipelines (319,372) from 2012 through 2021 obtained from the USDOT Pipeline and Hazardous Materials Safety Administration (USDOT 2022), there was one incident for each 2,802 miles of pipeline per year on average.

General public health and safety would not be at risk in the event of an accidental spill on site. Emergency response would be provided by the local, regional, and state law enforcement, fire, and emergency responders. Overall, effects to public health and safety in association with construction and operation of the gas pipeline lateral would be minor.

As detailed in TGP's Resource Report 11 (TGP 2022k):

> The primary causes of pipeline incidents between 2012 and 2021 were: 1) material/weld/equipment failure, 2) internal/external corrosion, 3) natural force damage, and 4) other outside force damage. TGP would address each of these potentially adverse events for the pipeline facilities by implementing safety practices and procedures during construction and operations. These practices and procedures will meet or exceed the USDOT's pipeline safety regulations and will include:
>
> - Using high quality and certified materials from approved vendors;
> - Employing experienced and qualified inspection forces during construction;
> - Installing high quality protective coating on piping;
> - Hydrostatically testing the completed facilities;
> - Utilizing electronic "smart pig" technology to locate and correct any defects in the new pipeline prior to placing it in service. Once the pipeline is in service, electronic "smart pig" technology will be utilized at regular intervals to ensure that the integrity of the pipeline is maintained (this practice is in accordance with the USDOT's Integrity Management rule);
> - Utilizing cathodic protection systems to prevent corrosion;
> - Continuously monitoring operations and pressures using a remote sensing system, which will be monitored 24 hours a day/seven days a week from TGP's Gas Control Center located in Houston, Texas; and
> - Fully complying with the USDOT pipeline safety regulations set forth in 49 CFR Part 192 regarding the design, construction, operation and maintenance of the pipeline facilities.
>
> In the event of an incident, TGP field operations personnel located in the vicinity of the pipeline facilities would respond to the event. TGP field operations personnel are available to be dispatched 24 hours a day/seven days a week by TGP's Gas Control Center located in Houston, Texas via cell phone communications.

> TGP has Operations, Maintenance, and Inspection Manuals for operations of their system and would apply these standards to all aspects of the pipeline facilities operations. TGP has an Emergency Response Plan that incorporates procedures for identifying an emergency event and establishing communication with local fire, police, and public officials. TGP would participate in a One-Call program for all of its facilities and has a public awareness program for its natural gas facilities.
>
> The proposed pipeline facilities will be designed, constructed, operated and maintained in accordance with the USDOT pipeline safety regulations in 49 CFR Part 192.
>
> The USDOT also defines four area classifications, based on population density near pipeline facilities, and specifies more rigorous safety requirements for more populated areas. A class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. Two of the area classifications are applicable to the proposed pipeline facilities:
>
> - Class 1: Location with 10 or fewer buildings intended for human occupancy.
> - Class 2: Location with more than 10 but fewer than 46 buildings intended for human occupancy.

Table 3.15-1 describes the class designations for different segments of the proposed pipeline. Each of the classes has different safety factors for pipeline design, testing, and operation.

According to TGP's Resource Report 11 (TVA 2022k):

> For example, pipelines constructed on land in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil and 18 inches in consolidated rock. Class 2 locations as well as drainage ditches of public roads and railroad crossings, require a minimum cover of 36 inches in normal soil and 24 inches in consolidated rock. The USDOT has also published rules that define high-consequence areas ("HCAs") where a gas pipeline accident could do considerable harm to people and their property and requires an integrity management program to minimize the potential for an accident. The HCAs are areas where a release could have the most significant adverse consequences and are based upon population, the current mainline pipe diameter, and maximum allowable operating pressure. The proposed pipeline does not cross any HCAs.

Table 3.15-1. USDOT Class Locations Along the Cumberland Pipeline (Source: TGP 2022k)

Mile Post	Class 1	Class 2
0 – 0.83		X
0.84 – 5.77	X	
5.78 – 7.37		X
7.38 – 13.74	X	
13.75 – 14.61		X
14.62 – 16.36	X	
16.37 – 17.65		X
17.66 – 23.36	X	
23.37 – 24.70		X
24.71 – 26.20	X	
26.21 – 27.66		X
27.67 – 29.75	X	
29.76 – 30.24		X
30.25 - 32	X	

With the continuing advancements in materials and pipeline operating and maintenance practices, the chances of a failure of the pipeline facilities are extremely low. In addition, the safety and reliability of the proposed [pipeline] facilities will be based on safe design, appropriate equipment selection, code compliance, thorough review, careful construction, and competent maintenance and operation. Measures will be incorporated according to approved design practices and standards. Measures to protect the public from inadvertent natural gas releases due to accidents or natural catastrophes can be grouped into three categories: passive protection, active controls and procedural controls.

[…] Passive protection minimizes the hazards by process and equipment design features, which reduce either the frequency or consequence of a hazard without the active functioning of a device. These passive controls have been implemented for the existing facilities and will be implemented for the [pipeline] project.

Active (or engineering) controls use instruments, valves, safety interlocks, and traffic control and emergency shutdown systems to detect and correct process deviations (e.g., line break detection systems). These active controls will be implemented for the proposed [pipeline] facilities and updated, as needed, during construction and operation […].

[…] Procedural (or administrative) controls use operating procedures, administrative checks, emergency response, and other management approaches to prevent incidents, or to minimize the effects of an accident (e.g., operating procedures, safe work practices, inspections and testing, and training). These

> procedural controls will be implemented for the proposed [pipeline] facilities, and will be updated as needed.
>
> […] The [pipeline] facilities follow the KM Corporate Security Plan, with the Transportation Security Administration's "Pipeline Security Guidelines" (TSA 2018) serving as a primary guiding document for the overall plan and program.
>
> […] Safety and security concerns have changed the way pipeline operators as well as regulators must consider terrorism, both in approving new projects and in operating existing facilities. The Office of Homeland Security is tasked with the mission of coordinating the efforts of all executive departments and agencies to detect, prepare for, prevent, protect against, respond to, and recover from terrorist attacks within the United States. Among its responsibilities, the Office of Homeland Security oversees the Homeland Infrastructure Threat and Risk Analysis Center, which analyzes and implements the National Critical Infrastructure Prioritization Program. The National Prioritization Program supports state and incident management prioritization domestically through the Tier 1 and Tier 2 assets. The Tier 1 and Tier 2 lists are key components of infrastructure protection programs and are used to prioritize infrastructure protection, response, and recovery activities.
>
> […] In accordance with the USDOT surveillance requirements, TGP will incorporate air and ground inspection of its proposed [pipeline] facilities into its inspection and maintenance program.
>
> Security measures at the pressure regulation station, MLV, and meter station include security fencing to enclose the operational areas of each facility. In addition, each of the pig launcher/receiver facilities will also be enclosed within a fence to restrict access to only authorized personnel.

During construction of the pipeline, truck traffic of other projects in the area could add to the traffic. This could result in cumulative safety effects as a result of the cumulative traffic effects from nearby projects. Effects would be anticipated to be temporary and minor and would affect primarily the truck drivers and construction personnel. Controls would be needed to ensure truck traffic is coordinated and safe. See TGP's Resource Report 11 for a detailed list of safety procedures (TGP 2022k).

With proper planning, adherence to OSHA regulations and health and safety plans, and implementation of BMPs, cumulative effects from the project in relation to public health and safety would not occur.

3.15.3.4.3. Summary of Alternative A

In sum, during construction of the CC Plant and pipeline, workers would have an increased safety risk that would be mitigated through BMPs; however, there would be safety risks from increased traffic during construction. General public health and safety would not be at risk in the event of an accidental spill on site due to precautionary measures. Public health would be improved by improving air quality from coal generation replacement. The greatest hazard during pipeline construction and operation is a fire that may result in the event of a major pipeline rupture or leak. A number of precautionary systems and response measures will be in place to mitigate this risk to workers and the public.

3.15.3.4.4. Environmental Justice Considerations

Safety-related effects due to the CC plant and pipeline may be experienced by EJ populations, and some of these effects would be heightened near high traffic construction areas. Given their proximity to the CC plant vicinity and the two identified contractor yards, the Cumberland Meter Station and major roads along the pipeline corridor, EJ populations have the potential to experience amplified safety effects.

3.15.3.5. Alternative B

3.15.3.5.1. Construction and Operation of CT Plant at Johnsonville Reservation

Under Alternative B, TVA would construct and operate a new CT plant on the JCT Reservation. During the construction of the CT plant, workers would have an increased safety risk. However, because construction work has known hazards, the standard practice is for contractors to establish and maintain health and safety plans in compliance with OSHA regulations. See Section 2.3.1 for more details on standard BMPs.

CT plants require the movement of fuel gas and oil. An SPCC plan would be implemented to minimize the potential of a spill during construction and operation and to instruct on-site workers on how to contain and clean up any potential spills. Security fencing around the site boundary will be installed during construction. Once the plant is operational, permanent security fencing will be installed. General public health and safety would not be at risk in the event of an accidental spill on site. Emergency response would be provided by the local, regional, and state law enforcement, fire, and emergency responders.

The public health and safety effects of air quality from CT operations would be negligible. Operating the CT plant would require air emissions monitoring. Reduction of NO_x emissions from the CTs would be achieved through DLN combustion systems. Exhaust stacks would be equipped with continuous emissions monitoring systems. Emissions from the units would adhere to the requirements of TDEC and federal regulations.

During construction of the CT plant, truck traffic of other projects in the area, such as the adjacent Aeroderivative CT project, could add to the traffic. This could result in cumulative safety effects as a result of the cumulative traffic effects from nearby projects. Effects would be anticipated to be temporary and minor and would affect primarily the truck drivers and construction personnel. Controls would be needed to ensure truck traffic is coordinated and safe. With proper planning, adherence to OSHA regulations and health and safety plans, and implementation of BMPs, cumulative effects from the project in relation to public health and safety would not occur.

3.15.3.5.2. Construction and Operation of CT Plant at Gleason Reservation

Under Alternative B, TVA would construct and operate a new CT plant on the Gleason Reservation. Effects to health and safety and the measures to address effects are the same as those described in Section 3.15.3.5.1 for the JCT CT plant.

3.15.3.5.3. Transmission and Other Components

New double breaker bays would be added, and switchyards would be added, or current switchyards expanded at both JCT and Gleason. A new 40-mile 500-kV TL would also be constructed. All unit substation transformers would be oil filled; therefore, concrete foundations and an oil containment system would be included. During construction, workers would have an increased safety risk. However, because construction work has known hazards, the standard practice is for contractors to establish and maintain health and safety plans in compliance with

OSHA regulations. TL safety effects would be comparable to those discussed in Section 3.15.3.4.1.

3.15.3.6. Alternative C

3.15.3.6.1. Construction and Operation of Solar and Storage Facilities

Under Alternative C, TVA would construct and operate 3,000 MW of solar and 1,700 MW of battery storage at various sites, primarily in Middle Tennessee. During construction, workers would have an increased safety risk typical for other construction activities. Particular caution would be taken when handling solar panels due to the potential for electric shock. The standard practice is for contractors to establish and maintain health and safety plans in compliance with OSHA regulations. See Section 2.3.1 for more details on standard BMPs.

Once solar panels are installed and in operation, they are considered to be very safe for humans and wildlife. Solar projects do not cause EMF levels such that there will be effects on nearby residents. Sites are typically designed and operated using standard industry practices with sufficient setbacks to reduce or eliminate EMF exposure to adjacent property owners. EMF strength is typically measured in milli-gauss (mG). While long-term exposure to levels above 4mG is still identified as a concern (Cleveland 2017); the EMF generated by the solar facilities and associated transmission lines are typically less than 4mG.

The perimeter of each grouping of solar arrays, as well as substations and energy storage facilities, would remain securely fenced during construction and operation, and access gates would normally remain locked. Security fencing around the site boundary would be installed during construction. Once the facility is operational, permanent security fencing would be installed.

The construction of Alternative C combined with the RFFA of planned 10,000 MW expansions of solar facilities could result in cumulative safety effects as a result of the cumulative traffic effects from nearby projects. Effects would be anticipated to be temporary and minor and would affect primarily the truck drivers and construction personnel. Controls would be needed to ensure truck traffic is coordinated and safe. With proper planning, adherence to OSHA regulations and health and safety plans, and implementation of BMPs, cumulative effects from the project in relation to public health and safety would not occur.

3.15.3.6.2. Transmission and Other Components

The extent of transmission lines necessary under Alternative C is not yet known. Transmission line effects to safety would be comparable to those discussed in Section 3.15.3.4.1.

3.16. Socioeconomics

Social, economic, and sociocultural characteristics of potentially affected populations are assessed in this section using the 2010 Census, 2020 Census, and the 2019 ACS. State-level USCB data are included for comparison purposes. These data were obtained utilizing USCB Explore Census Data (USCB 2021). Where appropriate, additional data from USCB and other federal and state agencies are employed.

The area considered for socioeconomic analysis varies relative to the alternative and corresponds to the extent of effects (both adverse and beneficial) anticipated for that alternative (Figure 3.16-1). The area considered for the CUF Reservation and for the TVA facilities associated with Alternative B is the approximated geographic area from which the labor market is derived. The labor market area consists of the counties where the facilities are located and all

adjacent counties. For the natural gas pipeline associated with Alternative A, the extent of effects are expected to be more limited than those associated with the proposed CC and CT plants, while also representing a temporary labor market area given the local effects to employment from pipeline construction; thus, a three-mile radius of the pipeline is assessed for the socioeconomic analysis. To better represent the data given the smaller study area, census tract data, given as Census Tract number (e.g., CT 601) by county, are utilized to characterize socioeconomics in the linear pipeline corridor. [26]

For Alternative C, the area from which potentially affected populations are identified is the Middle Tennessee region of the TVA PSA (Figure 3.4-2), as assessed by the census data associated with each county in the region.

In evaluating beneficial and adverse effects to socioeconomics in relation to the natural gas pipeline associated with Alternative A, TVA incorporated the TGP socioeconomic findings (TGP 2022e). Detailed information regarding the affected environment in relation to socioeconomics in the pipeline study area are presented in the TGP Resource Reports, as described in Section 2.1.3.3.

[26] Whereas census block group data were used in the EJ analyses, census tract data were determined to be appropriate for the socioeconomic analysis pertaining to the pipeline. This is because socioeconomic analyses are not intended to identify sensitive populations that could be overlooked if the analyses are not conducted at a fine level of detail, such as achieved with census block group data, and instead are presenting characteristics of the general population pertaining to demographics, housing, employment, and income. These characteristics are appropriately represented at the census tract level, as commensurate with the anticipated socioeconomic effects.

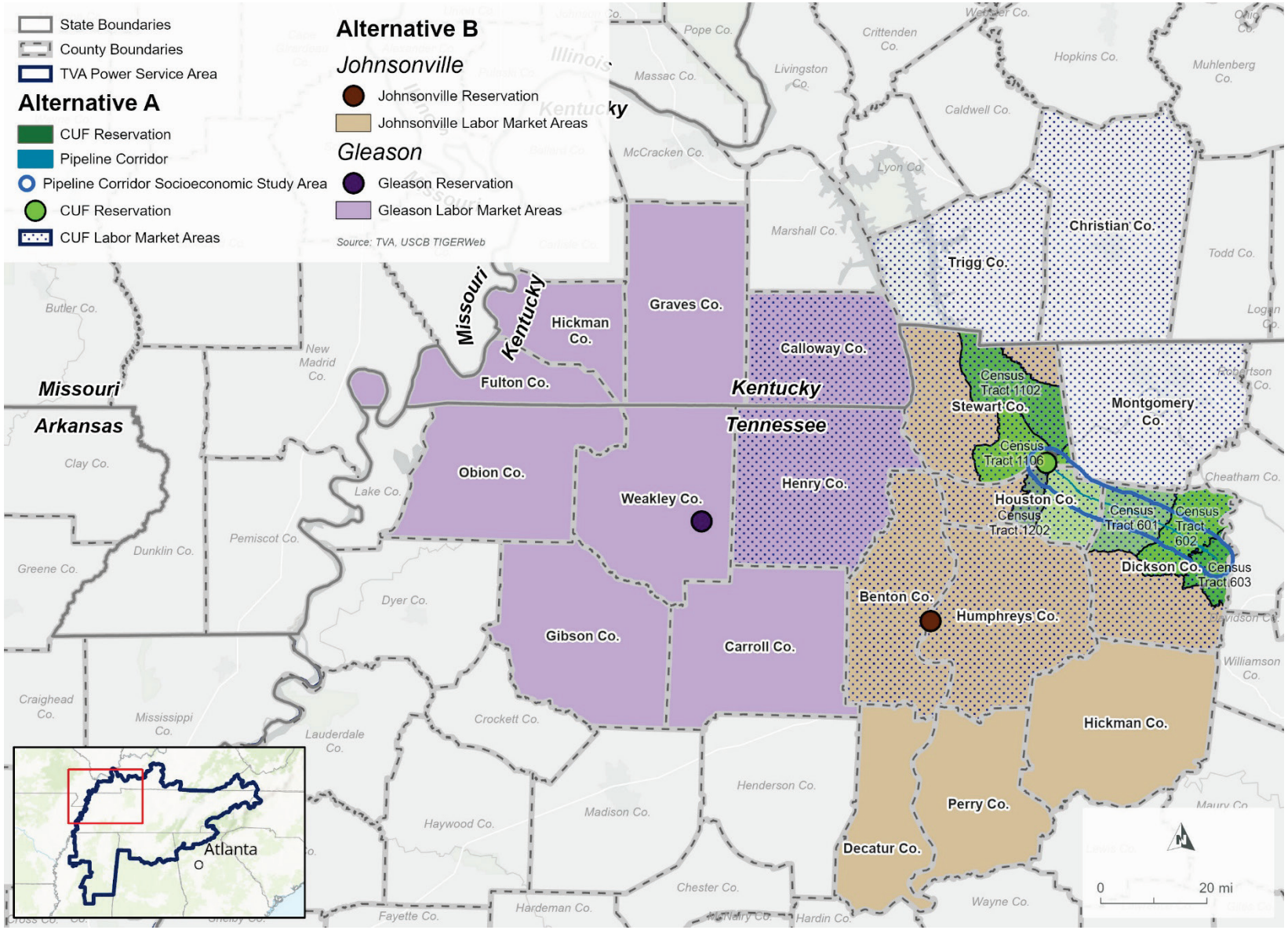

Figure 3.16-1. CUF Reservation and Alternative A and B Socioeconomic Study Areas

3.16.1. Affected Environment

3.16.1.1. CUF Reservation

The labor market area for CUF is Stewart County, where the facility is located, and Benton, Dickson, Henry, Houston, Humphreys, and Montgomery counties, also in Tennessee, and Calloway, Christian, and Trigg counties, Kentucky. The CUF labor market area is largely rural but includes a few small cities, the largest being Clarksville in Montgomery County, with 166,722 people in 2020; Hopkinsville in Christian County, with 31,180 people in 2020; Murray in Calloway County, with 17,307 people in 2020; and Dickson in Dickson County, with 16,058 people in 2020. The CUF labor market area also encompasses the transmission line corridors associated with Alternative A.

3.16.1.1.1. Demographics and Housing

Population data for the affected counties and associated states are provided in Table 3.16-1, based on the 2010 Census and the 2020 Census. As shown, from 2010 to 2020, population growth in all affected counties except Dickson and Montgomery counties was less than the growth for the associated states. Six of the 10 affected counties recorded population losses over that period. Of the affected counties, only Stewart County, where the CUF Reservation is located, and Dickson, Humphreys, and Montgomery counties recorded population gains over that period.

Table 3.16-1. Population Change for the CUF Labor Market Area

Geography	2010 Census	2020 Census	% Change
Tennessee	*6,346,105*	*6,910,840*	*8.9*
Stewart County (CUF)	13,324	13,657	2.5
Benton County	16,489	15,864	-3.8
Dickson County	49,666	54,315	9.4
Henry County	32,330	32,199	-0.4
Houston County	8,426	8,283	-1.7
Humphreys County	18,538	18,990	2.4
Montgomery County	173,331	220,069	27.7
Kentucky	*4,339,367*	*4,505,836*	*3.8*
Calloway County	37,191	37,103	-0.2
Christian County	73,955	72,748	-1.6
Trigg County	14,339	14,061	-1.9

Sources: 2010 Census; 2020 Census

Other demographic characteristics of the 10 affected counties, as compared with associated states, are summarized in Table 3.16-2, based on the 2019 ACS. The populations of affected counties were generally more aged than the state populations. The exceptions for this were in Montgomery, Calloway, and Christian counties, where the larger cities are present, and the populations were younger than the associated states. In Stewart County and all but three other affected counties, there were lower percentages of people who were high school graduates or higher than the associated states.

Table 3.16-2. Demographic Characteristics for the CUF Labor Market Area

Geography	% of Population 65 Years and Over	Median Age	% High School or Higher*	% of Occupied Housing Units, Renter Occupied	Median Year Housing Units Built
Tennessee	*16.0*	*38.7*	*87.5*	*33.7*	*1984*
Stewart County (CUF)	19.6	44.2	87.2	25.0	1986
Benton County	23.8	47.9	82.4	22.9	1985
Dickson County	15.5	39.1	83.7	24.9	1986
Henry County	22.8	45.1	85.9	23.8	1981
Houston County	20.9	43.9	77.2	23.5	1981
Humphreys County	19.3	42.0	84.9	22.2	1980
Montgomery County	9.1	30.8	92.9	40.5	1993
Kentucky	*16.0*	*38.9*	*86.3*	*32.8*	*1980*
Calloway County	16.8	35.6	89.5	37.6	1984
Christian County	12.1	28.3	85.6	51.9	1979
Trigg County	22.2	46.2	88.0	19.0	1990

*Of Population over 25 Years and includes High School Equivalency
Source: 2019 ACS

According to the 2019 ACS, the majority of affected counties, including Stewart County, had lower percentages of renter-occupied housing units than their respective state. In six of the affected counties, including Stewart County, housing units were generally newer than across the respective state.

3.16.1.1.2. Regional Economy, Employment, and Income

As of June 2021, CUF directly employed 252 people. This includes a range of positions such as general laborers, steamfitters, machinists, electricians, analysts, administrators, and supervisors. The CUF average annual salary is approximately 125 percent higher than the average annual wages per employee in affected counties, based on the Quarterly Census of Employment and Wages from the U.S. Bureau of Labor Statistics (USBLS; USBLS 2022). CUF also employs contractors for both short- and long-term operations labor support and contracts with coal and limestone mining operations and transportation companies that support additional employment and account for significant contributions to the area economy.

CUF also has indirect and induced effects on the local economy. Indirect effects result from changes in sales, income, or employment within the CUF region, and induced effects occur through the recirculation of money received through direct and indirect income sources and the subsequent creation of additional jobs and economic activities.

TVA makes payments in lieu of taxes, also called tax equivalent payments, to states where TVA sells electricity or owns power system assets. The payments total five percent of gross proceeds from the sale of power in the prior fiscal year (FY), with some exclusions. Tennessee Code Annotated Title 67, Chapter 9, Part 1 (T.C.A. § 67-9-102) directs how the funds are apportioned within the state and mandates that an individual county's portion of the total payment is determined by its proportion of population, total land area, and TVA-owned land in the county. Per T.C.A. § 67-9-102, in FY2021, $2.9 million of TVA's overall tax equivalent payment paid to Tennessee was allocated to Stewart County.

Table 3.16-3 summarizes 2019 ACS data on employment and income for the affected counties. All affected counties had lower percentages of people in the labor force than their respective state. Nine of the 10 affected counties, including Stewart County, had unemployment rates above that of the associated state. Based on the Quarterly Census of Employment and Wages from USBLS, the annual average total employment in Stewart County was estimated to be 2,759 in 2020 (USBLS 2022). Direct employment at CUF comprises about 9 percent of this total. Based on the 2019 ACS, per capita income in all affected counties except Trigg County was lower than that of their respective state.

Table 3.16-3. Employment and Income Characteristics for the CUF Labor Market Area

Geography	% of 16+ Civilian Population in Labor Force	Unemployment Rate	% Employed in Education Services, Healthcare, and Social Services	% Employed in Transportation, Manufacturing, and Utilities	Per Capita Income
Tennessee	*61.0*	*3.2*	*22.5*	*19.6*	*$29,859*
Stewart County (CUF)	52.2	6.4	20.3	21.5	$24,113
Benton County	47.4	6.8	27.8	20.0	$22,636
Dickson County	58.2	3.2	21.3	23.4	$27,115
Henry County	50.1	4.7	24.1	21.9	$24,124
Houston County	49.8	5.9	34.4	21.3	$22,360
Humphreys County	53.3	7.5	29.8	19.1	$25,428
Montgomery County	58.2	6.5	18.6	23.8	$26,923
Kentucky	*59.0*	*3.3*	*24.0*	*20.7*	*$28,178*
Calloway County	58.7	4.3	17.2	35.3	$23,219
Christian County	47.3	7.4	23.7	24.1	$23,021
Trigg County	53.7	9.2	23.4	23.2	$28,264

Source: 2019 ACS

Pertinent civilian employment characteristics for the affected counties are also shown on Table 3.16-3. Manufacturing and healthcare generally lead the industries for employment, with education services employing larger percentages, as well. Though not shown on Table 3.16-3, construction also employs larger percentages of people in the CUF labor market area. Stewart County and eight other affected counties exceeded state percentages for civilians employed in transportation, manufacturing, and utilities.

3.16.1.2. Alternative A

3.16.1.2.1. Natural Gas Pipeline Corridor

Census tracts within a three-mile radius of the pipeline corridor, called the pipeline corridor socioeconomic study area, include or touch seven census tracts within portions of Stewart, Houston, and Dickson counties in Tennessee.

3.16.1.2.1.1. Demographics and Housing

Population data for the pipeline corridor socioeconomic study area and Tennessee are provided in Table 3.16-4, based on the 2010 Census and the 2019 ACS. As shown, from 2010 to 2019, population growth in all affected counties was less than the growth for the state, and four of the seven census tracts recorded population losses over that period.

Table 3.16-4. Population Change in the Pipeline Corridor Socioeconomic Study Area

Geography	2010 Census	2019 ACS*	% Change
Tennessee	*6,346,105*	*6,709,356*	*8.9*
Dickson County			
CT 601 (Pipeline)	4,210	4,118	2.2
CT 602 (Pipeline)	6,625	7,215	-8.9
CT 603 (Pipeline)	6,376	6,845	-7.4
Houston County			
CT 1201 (Pipeline)	3,228	3,170	1.8
CT 1202 (Pipeline)	2,203	2,456	-11.5
Stewart County			
CT 1102	6,544	6,318	3.5
CT 1106 (Pipeline)	2,547	2,582	-1.4

*2019 ACS data was used for calculating % Change for this alternative rather than 2020 Census Data due to changes in census tract boundaries between the 2010 Census and 2020 Census.
Sources: 2010 Census; 2019 ACS

Other demographic characteristics of the affected census tracts, as compared to Tennessee, are summarized in Table 3.16-5, based on the 2019 ACS. The populations of all but two of the affected census tracts were more aged than the state population. The exceptions for this were in Dickson County CT 602 and Dickson County CT 603, near the city of Dickson, where the populations were younger than across Tennessee. In all but two affected census tracts, there were lower percentages of people who were high school graduates or higher than the state.

According to the 2019 ACS, all affected census tracts had lower percentages of renter-occupied housing units than the state. In five of the seven census tracts, housing units were newer than across the respective state. There are 278 vacant rental units in Dickson, Houston, and Stewart counties, and temporary accommodations offer a total of 150 to 400 units or rooms vacant as of January 2022.

Table 3.16-5. Demographic Characteristics in the Pipeline Corridor Socioeconomic Study Area

Geography	% of Population 65 Years and Over	Median Age	% High School or Higher*	% of Occupied Housing Units Renter Occupied	Median Year Housing Units Built
Tennessee	*16.0*	*38.7*	*87.5*	*33.7*	*1984*
Dickson County					
CT 601 (Pipeline)	16.1	42.9	87.5	16.3	1985
CT 602 (Pipeline)	13.4	38.1	76.3	24.8	1984
CT 603 (Pipeline)	12.1	38.2	76.5	24.6	1987
Houston County					
CT 1201 (Pipeline)	15.0	42.3	77.7	24.5	1985
CT 1202 (Pipeline)	25.1	44.1	78.1	25.6	1973
Stewart County					
CT 1102	17.7	42.1	90.0	25.5	1987
CT 1106 (Pipeline)	21.0	48.3	80.1	15.1	1989

*Of Population over 25 Years and includes High School Equivalency. Source: 2019 ACS

3.16.1.2.1.2. Employment and Income

Table 3.16-6 summarizes 2019 ACS data on employment and income for the pipeline corridor socioeconomic study area. All affected census tracts had lower percentages of people in the labor force than their respective state. Five of the seven affected census tracts had unemployment rates above that of the associated state. Based on the 2019 ACS, per capita income across the study area was lower than that of their respective state.

Table 3.16-6. Employment and Income Characteristics in the Pipeline Corridor Socioeconomic Study Area

Geography	% of 16+ Civilian Population in Labor Force	Unemployment Rate	% Employed in Education Services, Healthcare, and Social Services	% Employed in Transportation, Manufacturing, and Utilities	Per Capita Income
Tennessee	*61.0*	*3.2*	*22.5*	*19.6*	*$29,859*
Dickson County					
CT 601 (Pipeline)	54.8	1.0	19.6	21.9	$24,231
CT 602 (Pipeline)	49.0	5.1	29.8	21.3	$21,969
CT 603 (Pipeline)	59.0	5.2	21.9	13.7	$21,423
Houston County					
CT 1201 (Pipeline)	58.9	7.6	17.7	35.6	$22,841
CT 1202 (Pipeline)	43.0	2.4	26.7	33.7	$17,524
Stewart County					
CT 1102	55.8	6.5	25.3	20.4	$21,143
CT 1106 (Pipeline)	47.8	8.0	9.2	19.7	$24,104

Source: 2019 ACS

Pertinent civilian employment characteristics for the affected census tracts are also shown on Table 3.16-6. In the pipeline corridor socioeconomic study area, manufacturing and healthcare generally lead the industries for employment, with education services employing larger percentages, as well. Though not shown on Table 3.16-6, construction also employs larger percentages of people in the pipeline corridor socioeconomic study area. All but one census tract exceeded state percentages for civilians employed in transportation, manufacturing, and utilities.

3.16.1.3. Alternative B

3.16.1.3.1. Johnsonville Reservation

The labor market area for JCT is Humphreys County, where the facility is located, and Benton, Decatur, Dickson, Hickman, Houston, and Perry counties, Tennessee. The Johnsonville labor market area is largely rural but includes the more urban area associated with Dickson in Dickson County, which had a population of 16,058 in 2020.

3.16.1.3.1.1. Demographics and Housing

Population data for the affected counties and associated state are provided in Table 3.16-7, based on the 2010 Census and the 2020 Census. As shown, from 2010 to 2020, population growth in all affected counties except Dickson County was less than the growth for the state. Three of the seven affected counties recorded population losses over that period. Of the affected counties, only Humphreys County, where the Johnsonville Reservation is located, and Dickson, Hickman, and Perry counties recorded population gains over that period.

Table 3.16-7. Population Change for the Johnsonville Labor Market Area

Geography	2010 Census	2020 Census	% Change
Tennessee	*6,346,105*	*6,910,840*	*8.9*
Humphreys County (Johnsonville)	18,538	18,990	2.4
Benton County	16,489	15,864	-3.8
Decatur County	11,757	11,435	-2.7
Dickson County	49,666	54,315	9.4
Hickman County	24,690	24,925	1.0
Houston County	8,426	8,283	-1.7
Perry County	7,915	8,366	5.7

Sources: 2010 Census; 2020 Census

Other demographic characteristics of the seven affected counties, as compared with the state, are summarized in Table 3.16-8, based on the 2019 ACS. The populations of affected counties were more aged than the state population. In all affected counties, there were lower percentages of people who were high school graduates or higher than the state.

Table 3.16-8. Demographic Characteristics for the Johnsonville Labor Market Area

Geography	% of Population 65 Years and Over	Median Age	% High School or Higher*	% of Occupied Housing Units, Renter Occupied	Median Year Housing Units Built
Tennessee	*16.0*	*38.7*	*87.5*	*33.7*	*1984*
Humphreys County (Johnsonville)	19.3	42.0	84.9	22.2	1980
Benton County	23.8	47.9	82.4	22.9	1985
Decatur County	23.4	46.4	85.9	19.0	1981
Dickson County	15.5	39.1	83.7	24.9	1986
Hickman County	16.8	41.1	78.6	19.7	1983
Houston County	20.9	43.9	77.2	23.5	1981
Perry County	20.5	43.2	74.9	17.6	1987

*Of Population over 25 Years and includes High School Equivalency
Source: 2019 ACS

According to the 2019 ACS, all affected counties had lower percentages of renter-occupied housing units than the state. In all but three of the affected counties, housing units were generally older than across Tennessee.

3.16.1.3.1.2. Employment and Income

Table 3.16-9 summarizes 2019 ACS data on employment and income for the affected counties. All affected counties had lower percentages of people in the labor force than the state. Six of the seven affected counties, including Humphreys County, had unemployment rates above that of

Tennessee as a whole. Based on the Quarterly Census of Employment and Wages from USBLS, the annual average total employment in Humphreys County was estimated to be 5,790 in 2020 (USBLS 2022). Based on the 2019 ACS, per capita income in all affected counties was lower than that of the state.

Table 3.16-9. Employment and Income Characteristics for the Johnsonville Labor Market Area

Geography	% of 16+ Civilian Population in Labor Force	Unemployment Rate	% Employed in Educational Services, Healthcare, and Social Services	% Employed in Transportation, Manufacturing, and Utilities	Per Capita Income
Tennessee	*61.0*	*3.2*	*22.5*	*19.6*	*$29,859*
Humphreys County (Johnsonville)	53.3	7.5	29.8	19.1	$25,428
Benton County	47.4	6.8	27.8	20.0	$22,636
Dickson County	58.2	3.2	21.3	23.4	$27,115
Decatur County	51.5	9.3	25.0	26.4	$23,857
Hickman County	51.4	4.0	23.5	20.5	$22,856
Houston County	49.8	5.9	34.4	21.3	$22,360
Perry County	47.1	8.6	31.9	27.6	$27,970

Source: 2019 ACS

Pertinent civilian employment characteristics for the affected counties are also shown on Table 3.16-9. Manufacturing and healthcare generally lead the industries for employment, with education services employing larger percentages, as well. Though not shown on Table 3.16-9, construction also employs larger percentages of people in the Johnsonville labor market area. All affected counties except Humphreys County exceeded state percentages for civilians employed in transportation, manufacturing, and utilities.

3.16.1.3.2. Gleason Reservation

The labor market area for Gleason is Weakley County, where the facility is located, and Carroll, Gibson, Henry, and Obion counties, Tennessee, and Calloway, Fulton, Graves, and Hickman counties, Kentucky. The Gleason labor market area is largely rural but includes the more urban area associated with Murray in Calloway County, which had a population of 17,307 in 2020. The CUF labor market area also encompasses the transmission line corridors associated with Alternative B. These occur within Weakley and Henry counties.

3.16.1.3.2.1. Demographics and Housing

Population data for the affected counties and associated states are provided in Table 3.16-10, based on the 2010 Census and the 2020 Census. As shown, from 2010 to 2020, population growth in all affected counties was less than the growth for the two states. All but one of the affected counties recorded population losses over that period. Of the affected counties, only Gibson County, near the urban areas associated with Dyersburg and Jackson, Tennessee (both outside the Gleason labor market area), recorded population gains over that period.

Table 3.16-10. Population Change for the Gleason Labor Market Area

Geography	2010 Census	2020 Census	% Change
Tennessee	*6,346,105*	*6,910,840*	*8.9*
Weakley County (Gleason)	35,021	33,510	-6.1
Carroll County	28,522	27,886	-0.3
Gibson County	49,683	49,228	1.5
Henry County	32,330	32,284	-0.4
Obion County	31,807	30,365	-3.2
Kentucky	*4,339,367*	*4,505,836*	*3.8*
Calloway County	37,191	38,837	-0.2
Fulton County	6,813	6,130	-4.4
Graves County	37,121	37,248	-1.3
Hickman County	4,902	4,510	-7.8

Sources: 2010 Census; 2020 Census

Other demographic characteristics of the nine affected counties, as compared with the states, are summarized in Table 3.16-11, based on the 2019 ACS. The populations of all but two affected counties were more aged than the state population. The exceptions to this were in Weakley County, where the Gleason Reservation is located, and Calloway County, where the city of Murray is located. In all affected counties except Calloway and Graves counties, there were lower percentages of people who were high school graduates or higher than the state.

According to the 2019 ACS, Weakley County and three of the nine other affected counties had higher percentages of renter-occupied housing units than the state. In all but one of the affected counties, housing units were generally older than across the associated state. The exception to this was in Calloway County, where Murray is located.

Table 3.16-11. Demographic Characteristics for the Gleason Labor Market Area

Geography	% of Population 65 Years and Over	Median Age	% High School or Higher*	% of Occupied Housing Units, Renter Occupied	Median Year Housing Units Built
Tennessee	*16.0*	*38.7*	*87.5*	*33.7*	*1984*
Weakley County (Gleason)	18.0	38.6	85.1	34.7	1977
Carroll County	19.9	42.5	84.1	26.9	1976
Gibson County	17.7	39.9	85.3	31.7	1975
Henry County	22.8	45.8	85.9	23.8	1981
Obion County	19.8	42.6	83.5	35.1	1974
Kentucky	*16.0*	*38.9*	*86.3*	*32.8*	*1980*
Calloway County	16.8	35.6	89.5	37.6	1984
Fulton County	20.1	43.5	79.1	38.7	1970
Graves County	18.2	39.7	87.4	24.5	1977
Hickman County	24.3	48.0	80.1	17.2	1976

*Of Population over 25 Years and includes High School Equivalency
Source: 2019 ACS

3.16.1.3.2.2. Employment and Income

Table 3.16-12 summarizes 2019 ACS data on employment and income for the affected counties. All affected counties had lower percentages of people in the labor force than their

respective state. All the affected counties, including Weakley County, had unemployment rates above that of the associated state. Based on the Quarterly Census of Employment and Wages from the U.S. Bureau of Labor Statistics, the annual average total employment in Weakley County was estimated to be 10,715 in 2020 (USBLS 2022). Based on the 2019 ACS, per capita income in all affected counties was lower than that of their respective state.

Table 3.16-12. Employment and Income Characteristics for the Gleason Labor Market Area

Geography	% of 16+ Civilian Population in Labor Force	Unemployment. Rate	% Employed in Educational, Healthcare, and Social Services	% Employed in Transportation, Manufacturing, and Utilities	Per Capita Income
Tennessee	*61.0*	*3.2*	*22.5*	*19.6*	*$29,859*
Weakley County (Gleason)	54.4	5.6	23.4	28.8	$22,755
Carroll County	52.2	5.3	23.0	26.1	$22,394
Gibson County	55.2	6.1	22.6	23.0	$23,211
Henry County	50.1	4.7	24.1	21.9	$24,124
Obion County	55.6	5.5	25.4	21.5	$23,375
Kentucky	*59.0*	*3.3*	*24.0*	*20.7*	*$28,178*
Calloway County	58.7	4.3	17.2	35.3	$23,219
Fulton County	45.3	10.2	24.0	22.0	$18,247
Graves County	57.0	6.1	21.1	26.6	$24,750
Hickman County	45.7	7.0	20.0	30.6	$28,114

Source: 2019 ACS

Pertinent civilian employment characteristics for the affected counties are also shown on Table 3.16-12. Manufacturing and healthcare generally lead the industries for employment, with education services employing larger percentages, as well. Though not shown on Table 3.16-12, construction also employs larger percentages of people in the Gleason labor market area. All affected counties exceeded state percentages for civilians employed in transportation, manufacturing, and utilities.

3.16.1.4. Alternative C

3.16.1.4.1. Middle Tennessee TVA Power Service Area

The Alternative C socioeconomic study area consists of the Middle Tennessee region, as based on regions in the TVA PSA defined by the TVA Economic Development team (TVA 2022e; Figure 3.4-2). The Alternative C socioeconomic study area is separated into its 24 associated counties for evaluation purposes.

3.16.1.4.1.1. Demographics and Housing

Population data for the 24 counties in Middle Tennessee are provided in Table 3.16-13 in comparison with Tennessee as a whole, based on the 2010 Census and the 2020 Census. As shown, from 2010 to 2020, population growth in 14 of the 24 counties was less than the growth for the state. Two counties, Houston and Maury counties, recorded population losses over that period.

Table 3.16-13. Population Change in the Alternative C Socioeconomic Study Area

Geography	2010 Census	2020 Census	% Change
Tennessee	*6,346,105*	*6,910,840*	*8.9*
Bedford County	45,058	50,237	11.5
Cheatham County	39,105	41,072	5.0
Coffee County	52,796	57,889	9.6
Davidson County	626,681	715,884	14.2
Dickson County	49,666	54,315	9.4
Franklin County	41,052	42,774	4.2
Giles County	29,485	30,346	2.9
Hickman County	24,690	24,925	1.0
Houston County	8,426	8,283	-1.7
Humphreys County	18,538	18,990	2.4
Lawrence County	41,869	44,159	5.5
Lewis County	12,161	12,582	3.5
Lincoln County	33,361	35,319	5.9
Marshall County	52,266	53,276	1.9
Maury County	26,075	25,866	-0.8
Montgomery County	172,331	220,069	27.7
Moore County	6,362	6,461	1.6
Perry County	7,915	8,366	5.7
Robertson County	66,283	72,803	9.8
Rutherford County	262,604	341,486	30.0
Stewart County	13,324	13,657	2.5
Sumner County	160,645	196,281	22.2
Williamson County	183,182	247,726	35.2
Wilson County	113,993	147,737	29.6

Sources: 2010 Census; 2020 Census

Other demographic characteristics of Middle Tennessee, as compared with the state, are summarized in Table 3.16-14 based on the 2019 ACS. In half of the 24 counties, the populations in the study area were more aged than the respective states. Except in seven counties, there were lower percentages of people who were high school graduates or higher than across the state.

According to the 2019 ACS, the counties in Middle Tennessee generally had lower percentages of renter-occupied housing units than across the state. In most counties, housing units were newer than across the state.

Table 3.16-14. Demographic Characteristics of the Alternative C Socioeconomic Study Area

Geography	% of Population 65 Years and Over	Median Age**	% High School or Higher*	% of Occupied Housing Units, Renter Occupied	Median Year Housing Units Built**
Tennessee	*16.0*	*38.7*	*87.5*	*33.7*	*1984*
Bedford County	15.0	37.9	82.1	31.5	1986
Cheatham County	14.6	40.3	87.0	23.0	1988
Coffee County	17.2	39.7	85.4	31.9	1984
Davidson County	12.0	34.3	89.1	45.7	1981
Dickson County	15.5	39.1	83.7	24.9	1986
Franklin County	19.4	42.2	87.5	25.5	1983
Giles County	19.8	43.9	85.8	30.4	1981
Hickman County	16.8	41.1	78.6	19.7	1983
Houston County	20.9	43.9	77.2	23.5	1981
Humphreys County	19.3	42	84.9	22.2	1980
Lawrence County	17.6	39.3	83.4	24.7	1979
Lewis County	20.5	43.3	84.3	22.0	1986
Lincoln County	18.9	42.6	83.5	24.9	1983
Marshall County	15.7	42.6	85.4	28.2	1986
Maury County	15.5	43.5	90.2	30.1	1989
Montgomery County	9.1	30.8	92.9	40.5	1993
Moore County	20.5	45	85.9	15.2	1988
Perry County	20.5	43.2	74.9	17.6	1987
Robertson County	14.5	39	87.2	26.0	1989
Rutherford County	10.2	33.5	91.8	34.8	1996
Stewart County	19.6	44.2	87.2	25.0	1986
Sumner County	15.6	39.8	89.7	26.4	1991
Williamson County	12.7	39.1	95.3	19.4	1997
Wilson County	15.4	40.4	91.6	23.2	1993

*Of Population over 25 Years and includes High School Equivalency
**For the PSA regions, the “medians” given are averages of the medians across the associated counties.
Source: 2019 ACS

3.16.1.4.1.2. Employment and Income

Table 3.16-15 summarizes 2019 ACS data on employment and income for the Alternative C socioeconomic study area. A majority of the 24 counties had lower percentages of people in the labor force and higher rates of unemployment than across the state. Based on the 2019 ACS, per capita income was lower than that of the state in 18 of the 24 counties.

Table 3.16-15. Employment and Income Characteristics for the Alternative C Socioeconomic Study Area

Geography	% of 16+ Civilian Population in Labor Force	Unemployment. Rate	% Employed in Educational Services, Healthcare, and Social Services	% Employed in Transportation, Manufacturing, and Utilities	Per Capita Income
Tennessee	*61.0*	*3.2*	*22.5*	*19.6*	*$29,859*
Bedford County	61.6	4.3	30.9	18.3	$24,864
Cheatham County	64.3	4.0	18.3	21.8	$27,893
Coffee County	59.7	4.5	31.1	17.2	$26,557
Davidson County	71.4	4.1	12.3	25.4	$36,440
Dickson County	58.2	3.2	21.3	23.4	$27,115
Franklin County	55.5	3.8	25.3	26.6	$28,317
Giles County	56.3	5.7	30.7	21.7	$25,690
Hickman County	51.4	4.0	23.5	20.5	$22,856
Houston County	49.8	5.9	34.4	21.3	$22,360
Humphreys County	53.3	7.5	29.8	19.1	$25,428
Lawrence County	54.1	8.1	27.5	25.3	$21,720
Lewis County	52.0	2.6	24.6	30.1	$21,516
Lincoln County	57.6	4.0	28.7	18.5	$26,965
Marshall County	60.6	6.0	31.5	21.0	$25,410
Maury County	63.6	4.0	30.0	25.6	$28,970
Montgomery County	58.2	6.5	18.6	23.8	$26,923
Moore County	55.1	4.8	33.5	21.9	$30,658
Perry County	47.1	8.6	31.9	27.6	$27,970
Robertson County	64.4	4.9	19.7	20.2	$29,524
Rutherford County	71.3	4.3	19.4	22.6	$30,159
Stewart County	52.2	6.4	20.3	21.5	$24,113
Sumner County	65.7	3.0	18.2	23.2	$33,851
Williamson County	68.8	2.8	10.1	26.4	$52,702
Wilson County	66.0	3.8	16.8	21.8	$34,575

Source: 2019 ACS

Pertinent civilian employment characteristics for the PSA are also shown on Table 3.16-15. Manufacturing and healthcare generally lead the industries for employment, with education services employing larger percentages, as well. Though not shown on Table 3.16-15, construction also employs larger percentages of people in Middle Tennessee. The region generally exceeded state percentages for civilians employed in transportation, manufacturing, and utilities.

3.16.2. Environmental Consequences

3.16.2.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to operate and maintain the CUF coal units as part of the TVA generation portfolio. TVA would implement all the planned actions related to the current and future management and storage of CCRs at the coal plants. Employment at CUF would continue to be an option in the labor market area, and contracts associated with CUF operations and any plant modifications and indirect and induced economic activities would continue to support the regional economy. However, the repairs and

maintenance necessary to maintain reliability, while providing local employment opportunities, may have a minor adverse effect on ratepayers.

3.16.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

The coal facilities at CUF would be retired between 2026 and 2033 and would transition to the D4 process detailed in Table 2.1-1, which would temporarily increase employment in Stewart County. Routine plant deliveries would also be discontinued. TVA payments in lieu of taxes to Tennessee and, subsequently, the portion allocated to Stewart County, would not likely reduce given that the CUF Reservation would remain TVA-owned property. All previously approved CCR projects would continue to be implemented.

With the phased unit retirements at CUF, contracts associated with coal operations and indirect and induced economic activities would also occur in phases and would be reduced, canceled, or cease. The 252 people currently employed by CUF may become temporarily unemployed with CUF coal facility retirement. While this decrease in employment represents approximately nine percent of total employment, as estimated for 2020 in Stewart County (USBLS 2022), minor direct adverse economic effects to the area would result. TVA will continue to identify employment opportunities across the TVA region for all interested employees. Given the prominence of several other employment options in the CUF vicinity, including manufacturing, educational services, health care, and construction, current CUF employees may potentially find alternative employment in these other industries. However, based on the 2019 ACS, the median earnings for full-time employment in these industries in affected counties are approximately $16,000 to $29,000 less on average than in the utilities industry. CUF employees and any associated family members may also temporarily relocate for work or follow recent depopulation trends and permanently relocate to outside the CUF area, and these changes may affect familial and community relations in the CUF labor market area.

Mining of coal and limestone for use at CUF and the transportation of these products to CUF provides additional regional employment. The retirement of the CUF coal facilities may result in indirect employment effects to the mining, trucking, and barge industries serving the plant. Unless the coal and limestone mines find alternative markets for the tonnage currently purchased by CUF, minor indirect adverse economic effects to the affected counties and the region from which these CUF products are purchased would occur from closure of this facility. Due to potential unemployment, reemployment in different industries, and relocations, these changes may also affect familial and community relations in the region from which these CUF products are purchased. Even with CUF coal closures, TVA anticipates having adequate gypsum supplies for several years following coal retirement and could continue to supply various companies with this product until the gypsum stores are depleted.

Construction of projects in vicinity to the CUF plant, such as the CCR management activities, could create short-term, beneficial cumulative effects to socioeconomics in the area.

3.16.2.2.1. Environmental Justice Considerations

Due to the loss of direct and indirect employment associated with CUF, competition for employment in other fields in the CUF labor market area, such as manufacturing, educational services, health care, and construction, may increase. Such trends could lead EJ populations and other populations to relocate for work or follow recent depopulation trends and permanently relocate to different locations in Tennessee or beyond. These changes may affect familial and community relations among EJ and other populations in the CUF labor market area. These

effects have the potential to be amplified on EJ populations that already face socioeconomic stressors.

3.16.2.3. Alternative A

3.16.2.3.1. Construction and Operation of CC Plant at CUF

Under Alternative A, the CUF coal facilities would be retired, as described in Section 3.16.2.2. The CC plant would be constructed on the CUF Reservation. While CUF coal closures would decrease employment in the CUF labor market area for the long-term, construction of the CC plant associated with Alternative A would temporarily increase employment in the area. Construction of the CC plant would take approximately three years and would provide up to 600 jobs at peak.

Ongoing employment at the new CC plant, anticipated to permanently employ approximately 25 to 35 people would be new employment options in the CUF labor market area and in the pipeline corridor socioeconomic study area and may be filled with current CUF employees.

Overall, there would be minor, short-term beneficial effects to employment during construction of the CC plant and minor, long-term beneficial effects during operations. Construction of projects in the vicinity of the proposed CC plant, such as the CCR management activities, could create short-term, beneficial cumulative effects to socioeconomics in the area.

3.16.2.3.2. Construction and Operation of Natural Gas Pipeline

The new CC plant would also require construction of approximately 32 miles of new 30-inch-diameter natural gas pipeline and associated gas system infrastructure in Stewart, Houston, and Dickson counties, which would temporarily increase employment and purchase of local materials in the area. TGP anticipates a maximum workforce of 300 to 400 people during construction of the pipeline. TGP expects that local workers would compose approximately 10 percent of the total construction workforce, with the remaining 90 percent coming from outside Dickson, Houston, and Stewart counties, which would have a net positive impact on employment, wages and household spending in the area (TGP 2022e). These employment increases may temporarily help offset some employment losses associated with CUF coal facility retirement.

As workers move into the areas for the construction of the pipeline, the workforce would likely reside in a combination of vacant rental housing and temporary housing and campgrounds in the areas surrounding the construction site. In total, the 278 vacant rental units in Dickson, Houston, and Stewart counties are insufficient by themselves for housing the non-local workers. Rental housing options are supplemented by other types of temporary accommodations. In total, these temporary accommodations offer a total of 150 to 400 units or rooms vacant as of January 2022. In addition, some non-local workers should likely seek housing outside the three-county area. For example, the nearby cities of Clarksville (Montgomery County), and Nashville (Davidson County) offer numerous additional housing options. These municipalities are located, at least in part, within an approximately 60-minute commute to much of the pipeline area. With all housing options considered, impacts to rental and temporary housing market may last for the duration of construction, approximately 12 months. These temporary impacts may be positive to the owners or proprietors of the housing units, their employees, if applicable, and state revenues through the associated seven-percent hotel/motel taxes but may be negative to current and prospective renters and guests of these homes and establishments through reduced availability of options and/or higher prices. Because TGP plans to use their existing personnel to operate and maintain the pipeline facilities and, therefore, does not anticipate hiring additional permanent position employees, long-term impacts to available housing in the

surrounding area are not expected (TGP 2022e). Overall, the beneficial socioeconomic effects associated with the construction of the pipeline would be short-term and minor. The pipeline would not have significant adverse impacts during construction nor operation on population, employment, regional or local services, or residences or businesses. There are potential adverse impacts to housing due to the limited availability of project-area housing options. The nature of the housing impacts would vary for homeowners and proprietors versus renters and guests. Overall, pipeline project activities would have temporary, short-term impacts on population, housing, and public services and would provide an overall net positive impact on employment and the local economy.

3.16.2.3.3. Summary of Alternative A

Construction of the CC plant and the pipeline associated with Alternative A would temporarily increase employment in the CUF labor market area and have a minor beneficial effect to area EJ populations.

3.16.2.3.4. Environmental Justice Considerations

While not anticipated to have significant adverse impacts on minority communities or other EJ populations, there may be negative effects to current and prospective renters and guests of rental homes and establishments through reduced rental inventory and/or increased prices. This has the potential to result in amplified effects for EJ-qualifying low-income populations, especially in EJ-qualifying census block groups with higher percentages of renter-occupied housing units than the associated county, such as Dickson County CT 602 BG 1 and BG 3 and Houston County CT 1201 BG 2.

3.16.2.4. Alternative B

Under Alternative B, the CUF coal facilities would be retired, as described in Section 3.16.2.2. TVA would replace the power generated by the existing CUF plant with new CT plants located at the existing Johnsonville and Gleason Reservations, in Humphreys and Weakley counties, respectively. Existing natural gas pipeline lateral and associated infrastructure are in place serving these two locations. While CUF coal closures would decrease employment in the CUF labor market area for the long-term, construction of the CT facilities associated with Alternative B would temporarily increase employment in the JCT and Gleason labor market areas, which partially overlap the CUF labor market area. Construction of the CT facilities would take approximately two years to complete and would provide up to 180 jobs at peak. Labor needs associated with operation of the new CT plants, anticipated to permanently employ approximately 8 to 12 people, would increase employment options in the JCT and Gleason labor market areas, which partially overlap the CUF labor market area. Overall, implementation of Alternative B would result in temporary and permanent employment increases that would help partially offset employment losses associated with CUF coal facility retirement. Construction of projects in vicinity to the JCT and Gleason plants, such as JCT Aeroderivative project, could create short-term, beneficial cumulative effects to socioeconomics in their respective labor markets.

3.16.2.5. Alternative C

TVA anticipates that a large portion of the solar facilities proposed under Alternative C would be physically located in the Middle Tennessee region. While specific sites have not yet been determined for evaluation under this alternative, typical socioeconomic effects associated with solar facilities include temporary beneficial effects to local population numbers; temporary and permanent beneficial effects to local employment; temporary indirect beneficial effects to the local economy; and long-term beneficial effects to the local tax base. Socioeconomic effects would be spread across approximately multiple sites in the Middle Tennessee region and TVA

power service area. Cumulative effects would also occur if Alternative C was combined with the 10,000 MW expansion of solar planned in the 2019 TVA IRP, as typical temporary benefits of construction employment would increase.

3.17. Noise

3.17.1. Regulatory Framework

Noise is unwanted or unwelcome sound that is usually caused by human activity and added to the natural acoustic setting of a locale. It is further defined as sound that disrupts normal activities and diminishes the quality of the environment. Community response to noise is dependent on the intensity of the sound source, its duration, the proximity of noise-sensitive land uses, and the time of day the noise occurs.

Sound is measured in units of decibels (dB) on a logarithmic scale. Because not all noise frequencies are perceptible to the human ear, A-scale weighting decibels (dBA), which filter out sound in frequencies above and below human hearing, are typically used in noise assessments. A noise level change of three dBA or less is barely perceptible to average human hearing, while a five dBA change in noise level is clearly noticeable. The noise level associated with a 10 dBA change is perceived as being twice as loud; whereas the noise level associated with a 20 dBA change is perceived to be four times as loud and may represent a “dramatic change” in loudness.

Frequency is measured in Hertz (Hz), which is the number of cycles per second. The typical human ear can hear frequencies ranging from approximately 20 to 20,000 Hz. Normally, the human ear is most sensitive to sounds in the middle frequencies (1,000 to 8,000 Hz) and is less sensitive to sounds in the low and high frequencies. As such, the A-weighted scale was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighted scale emphasizes sounds in the middle frequencies and de-emphasizes sounds in the low and high frequencies. Any sound level to which the A-weighted scale has been applied is expressed in dBA.

Sound in the environment is constantly fluctuating, for example, when a car drives by, a dog barks, or a plane passes overhead. Although an instantaneous sound level measured in dBA may indicate the level of noise experienced by an observer at that point in time, environmental noise levels vary continuously. Most ambient environmental noise includes a mixture of noise from some identifiable sources plus a relatively steady background noise where no particular source is identifiable. A single descriptor called the equivalent sound level (L_{eq}) is used to describe sound that is constant or changing in level. The L_{eq} is the average sound level for a specific time period.

The day-night sound level (Ldn) is the 24-hour equivalent sound level, which incorporates a 10 dBA correction penalty for the hours between 10 p.m. and 7 a.m. to account for the increased sensitivity of people to sounds that occur at night. Typical background day-night noise levels for rural areas range between 35 and 50 dB, whereas higher-density residential and urban areas background noise levels range from 43 dB to 72 dB (USEPA 1974). Background noise levels greater than 65 dBA can interfere with normal conversation, watching television, using a telephone, listening to the radio, and sleeping. Common indoor and outdoor noise levels from various noise sources are listed in Table 3.17-1.

The Noise Control Act of 1972, along with its subsequent amendments (Quiet Communities Act of 1978, USC 42 4901-4918), delegates authority to the states to regulate environmental noise

and directs government agencies to comply with local community noise statutes and regulations. Many local noise ordinances are qualitative, such as prohibiting excessive noise or noise that results in a public nuisance. Because of the subjective nature of such ordinances, they are often difficult to enforce. Some other local communities have noise ordinances that set allowable maximum noise levels for various activities.

The EPA 1974 guidelines recommend that Ldn not exceed 55 dBA for outdoor residential areas. The U.S. Department of Housing and Urban Development (HUD) considers an Ldn of 65 dBA or less to be compatible with residential areas (HUD 1985). For traffic-related noise, the Federal Highway Administration (FHWA) has set a threshold of 67 dBA as the sound level at which noise abatement should be considered (2011). Transportation noise primarily includes noise from truck traffic. Three primary factors influence highway noise generation: traffic volume, traffic speed, and vehicle type. Generally, heavier traffic volumes, higher speeds, and greater numbers of trucks increase the sound level of highway traffic noise. Other factors that affect the sound level of traffic noise include a change in engine speed and power, such as at traffic lights, hills, and intersecting roads and pavement type. Highway traffic noise is not usually a serious problem for people who live more than 500 feet from heavily traveled freeways or more than 100 to 200 feet from lightly traveled roads (FHWA 2011). Due to the nature of the decibel scale and the attenuating effects of noise with distance, a doubling of traffic would result in a 3 dBA increase in noise levels, which in and of itself would not normally be a perceivable noise increase.

The expected level of construction noise is dependent upon the nature and duration of each project. Construction activities for most large-scale projects would result in increased noise levels as a result of the operation of construction equipment onsite and the movement of construction-related vehicles (i.e., worker trips, and material and equipment trips) on the surrounding roadways. Noise levels associated with construction activities would increase ambient noise levels adjacent to the construction site and along roadways used by construction-related vehicles. Construction noise is generally temporary and intermittent in nature as it generally only occurs on weekdays during daylight hours which minimizes the effect to sensitive noise receptors.

Table 3.17-1. Common Indoor and Outdoor Noise Levels

Common Outdoor Noises	Sound Pressure Levels (dB)	Common Indoor Noises
	110	Rock Band at 5 meters (16.4 feet)
Jet Flyover at 300 meters (984.3 feet)		
	100	
		Inside Subway Train (New York)
Gas Lawn Mower at 1 meter (3.3 feet)		
	90	
		Food Blender at 1 meter (3.3 feet)
Diesel Truck at 15 meters (49.2 feet)		Garbage Disposal at 1 meter (3.3 feet)
	80	
		Shouting at 1 meter (3.3 feet)
Gas Lawn Mower at 30 meters (98.4 feet)	70	Vacuum Cleaner at 3 meters (9.8 feet)
Commercial Area		Normal Speech at 1 meter (3.3 feet)
	60	
		Large Business Office
	50	Dishwasher Next Room
Quiet Urban Daytime		
	40	Small Theater, Large Conference Room
Quiet Urban Nighttime		Library
Quiet Suburban Nighttime		
	30	
		Bedroom at Night
Quiet Rural Nighttime		Concert Hall (Background)
	20	
		Broadcast and Recording Studio
	10	
		Threshold of Hearing
	0	

Source: American Association of State Highway and Transportation Officials (AASHTO) 1993

3.17.2. Affected Environment

3.17.2.1. CUF Reservation

The existing CUF plant is on a large reservation of approximately 2,388 acres located on the shores of Barkley Reservoir in an industrial area. Noise generating sources in the vicinity of the project site include boat traffic, routine vehicle operations at the project site, and the existing coal-fired plant. Burns & McDonnell conducted a preliminary sound study for the proposed CC Plant associated with Alternative A. The study consists of sound monitoring of the existing environment and predictive sound modeling of the Project to analyze potential offsite sound impacts from its operation, and results are summarized below. The full study is attached in Appendix N.

Noise measurements for the existing ambient and baseline environment were collected in March of 2022 as recommended by American National Standards Institute (ANSI) S1.4. Two

continuous long-term sound level meters were set up at the measurement locations, labeled MP01 (NW corner of the CC plant site, near the Hollister House) and MP02 (SW corner of CC plant site), shown in Figure A-1 of Appendix N. The measurement periods for each sound monitor are given in Table 4-1 of Appendix N. The lowest one-hour sound levels for MP01 were 44 L_{eq} dBA in the daytime and 44 L_{eq} dBA at night. The lowest one-hour sound levels for MP02 were 34 L_{eq} dBA in the daytime and 32 L_{eq} dBA at night. The existing CUF coal-fired units were not operating, and the neighboring landfill had minimal to no activity during the measurement period. Local roadway traffic and naturally occurring sounds were the biggest contributors to measured sound levels.

Sensitive noise receptors in the vicinity of the proposed project area include residences and recreational areas. Lake Barkley Recreation Area adjoins the northern reservation boundary and Riverbend and Guices Creek recreation areas, both of which have developed recreation facilities (Section 3.9), are located approximately 0.3 miles north and 0.9 miles west of the reservation, respectively (see Figure 3.17-1). There are two residences on the demolition boundary along Cumberland City Road. See Table 3.17-2 for more information on the noise receptors.

3.17.2.2. Alternative A

3.17.2.2.1. Proposed CC Plant Site

The proposed CC plant site is in an undeveloped portion of the CUF Reservation comprised of fields and forest. The nearest residence, the Henry Hollister House, is located directly adjacent to the northern boundary of the CC plant site (Section 3.13.2 and Figure 3.17-1). Aside from the Henry Hollister House, the closest sensitive receptors to the proposed site include a farm building that lies on the border of the CC plant site and residential subdivisions with homes located approximately 0.7 miles east of the proposed plant site.

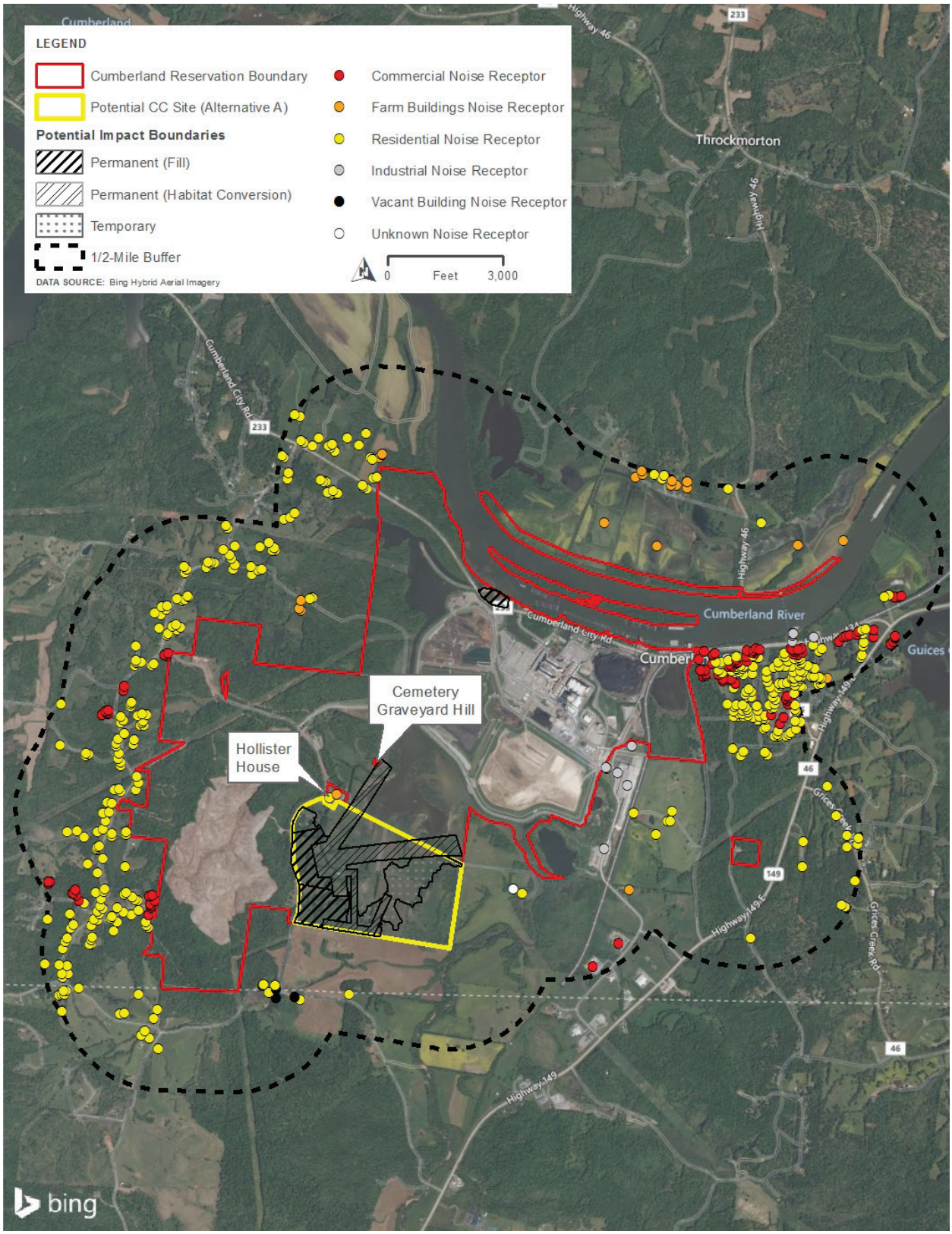

Figure 3.17-1. Noise Receptors within 0.5 mile of the CUF Reservation boundary.

Table 3.17-2. Noise Receptors within 0.5 mile of the Cumberland reservation

Noise Receptor Type	Alt A – CUF Reservation
Commercial	93
Farm building	22
Industrial	11
Residential	380
Vacant	4
Unknown	1
Total	**511**

3.17.2.2.2. Natural Gas Pipeline Corridor

Acoustical analyses for new aboveground facilities and planned HDDs (the loudest construction activity) during pipeline construction were conducted by Hoover & Keith Inc. ("H&K") and Stantec. Measurements of the current ambient noise levels at the site of the aboveground facilities and HDD sites for the planned HDD crossings associated with the pipeline were conducted in March 2022 by H&K. Noise measurement sites were selected in accordance with the Guidance Manual for Environmental Report Preparation for Applications Filed Under the Natural Gas Act, Volume I (FERC 2017)

Table 3.17-3 describes the identified representative NSAs impacted by each HDD and the above-ground facilities. "The noise impact analysis for each HDD was conservatively performed assuming the HDD pit nearest each individual NSA was an entry pit and the furthest HDD pit was an exit pit. The entrance pit has a higher sound power level than the exit pit, given the presence of the drill rig and additional supporting equipment. This assumption allows for the worst-case noise impact at each NSA to be modelled. Should field conditions require the HDD to be drilled in the opposite direction than modelled, no change in noise analysis is required. Although NSA09, NSA10, and NSA11 are located farther than 0.5 mile from the pipeline, those NSAs have been conservatively included in the analysis" (TGP 2022i).

Table 3.17-3. Alt A Pipeline Noise Receptors within 0.5 mile of the pipeline where pre-construction noise levels were measured

Location	NSA	NSA Type	NSA Location		Distance to Nearest HDD Pit or Station (Feet)	Directions to Nearest HDD Pit or Station
			Longitude	Latitude		
Jones Creek HDD (MP 3.0)	NSA01	Residence	36.19291	-87.24777	1,506	South
	NSA02	Residence	36.19281	-87.24122	2,171	Southwest
	NSA03	Residence	36.18861	-87.25507	2,459	East
Yellow Creek HDD (MP 12.0)	NSA04	Residence	36.29879	-87.54786	798	south
	NSA05	Residence	36.29755	-87.54611	719	West
	NSA06	Residence	36.29585	-87.54524	932	West
	NSA07	Residence	36.29471	-87.54701	785	Northwest
	NSA08	Residence	36.30114	-87.55760	1,853	East

Location	NSA	NSA Type	NSA Location		Distance to Nearest HDD Pit or Station (Feet)	Directions to Nearest HDD Pit or Station
			Longitude	Latitude		
Wells Creek HDD (MP 30.0)	NSA09	Residence	36.30448	-87.55716	2,466	Southeast
	NSA10	Residence	36.36224	-87.65742	2,666	Northwest
	NSA11	Residence	36.36823	-87.67160	3,052	Northeast
Pressure Regulation Station (MP 0.0)	NSA01s	Residence	36.16309	-99.20852	300	South
	NSA02s	Residence	36.16108	-99.20913	400	North
Cumberland Meter Station (MP 31.5)	NSA03s	Residence	36.36746	-99.67666	2,040	North

Source: TGP 2022i

As stated in TGP's Resource Report 9 (TGP 2022i):

> Noise measurements were collected in accordance with ANSI SC1.100-2014 "Methods to Defined and Measure the Residual Sound in Protected Natural and Quiet Residential Areas" where possible. Measurements were collected using a calibrated Type 1 Norsonics Model Nor-140 sound level meter. Ambient A-weighted equivalent sound levels and ambient unweighted octave-band sound pressure levels were collected at each measurement location. Collected measurements exclude extraneous or intermittent sounds generated by temporary sources of noise such as passing vehicles or overhead aircraft.
>
> […] A summary of measured daytime, nighttime and calculated pre-pipeline ambient sound levels is provided in [Table 3.17-4]. Daytime and nighttime measurements each consisted of three short-term noise samples lasting between 1-3 minutes in duration at the locations listed in [Table 3.17-3]. If noticeable variation was observed during the measurement, the duration of the measurements was increased to 10 to15 minutes to better quantify the steady-state ambient sound level.

The results of the noise measurements show low noise levels at all of the measured locations.

Table 3.17-4. Measured noise levels at noise receptors within 0.5 mile of the gas pipeline

Location	NSA ID	Measured Ambient[1] L_d (dBA)	Measured Ambient Ln (dBA)	Resulting L_{dn} (dBA)
Jones Creek HDD (MP 3.0)	NSA01	28.0	27.6	34.1
	NSA02	28.0	27.6	34.1
	NSA03	28.0	27.6	34.1
Yellow Creek HDD (MP 22.0)	NSA04	30.4	31.5	37.8
	NSA05	30.4	31.5	37.8
	NSA06	30.4	31.5	37.8
	NSA07	30.4	31.5	37.8
	NSA08	30.4	31.5	37.8
	NSA09	30.4	31.5	37.8
Wells Creek HDD (MP 30.0)	NSA10	30.41	31.51	37.8
	NSA11	30.41	31.51	37.8
Pressure Regulation Station (MP 0.0)	NSA01s	35.2	31.3	38.5
	NSA02s	40.3	31.9	41.0
Meter Station (MP 32.0)	NSA03s	41.1	42.4	48.7

1) Ambient sound level measurements were not collected at NSAs in proximity to HDD #3 as NSAs are farther than 0.5 miles from the HDD entry and exit pits. Measurements taken at NSAs in proximity to HDD #2 are considered representative of the ambient environment for NSAs in proximity to HDD #3
Source: TGP 2022i

3.17.2.2.3. Transmission Corridors

The proposed transmission lines associated with Alternative A would be contained within the CUF Reservation and have the same affected noise environment as described in Section 3.17.2.1.

3.17.2.3. Alternative B

3.17.2.3.1. Johnsonville Reservation

JCT is located along the east bank of the Tennessee River in an industrial area. Noise generating sources in the vicinity of the project site include periodic barge operations on the river, railroad operations, and routine vehicle operations at the existing reservation. All occupied buildings in the vicinity of the proposed CT plant site are industrial, and there are no nearby sensitive noise receptors (Figure 3.17-2).

Figure 3.17-2. Noise Receptors within 0.5 mile of the proposed CT plant site within the Johnsonville Reservation

3.17.2.3.2. Gleason Reservation

The Gleason reservation is located near the towns of Gleason and Dresden in Weakley County in an agricultural area. Noise generating sources in the vicinity of the project site include farm machinery, a nearby raceway, routine vehicle operations at the project site, and the currently operating CT plant. There are few sensitive noise receptors in the vicinity of the proposed CT plant site (Table 3.17-5 and Figure 3.17-3). The nearest noise-sensitive recreational areas are over a mile away from the site, and residential concentrations are largely to the southwest of Highway 22. However, there are a small number of residences within a mile of the plant, with the closest one approximately 1,600 feet to the north.

Table 3.17-5. Noise Receptors within 0.5 mile of the Gleason Reservation

Noise Receptor Type	Alt B – Gleason
Commercial	1
Residential	3
Total	**4**

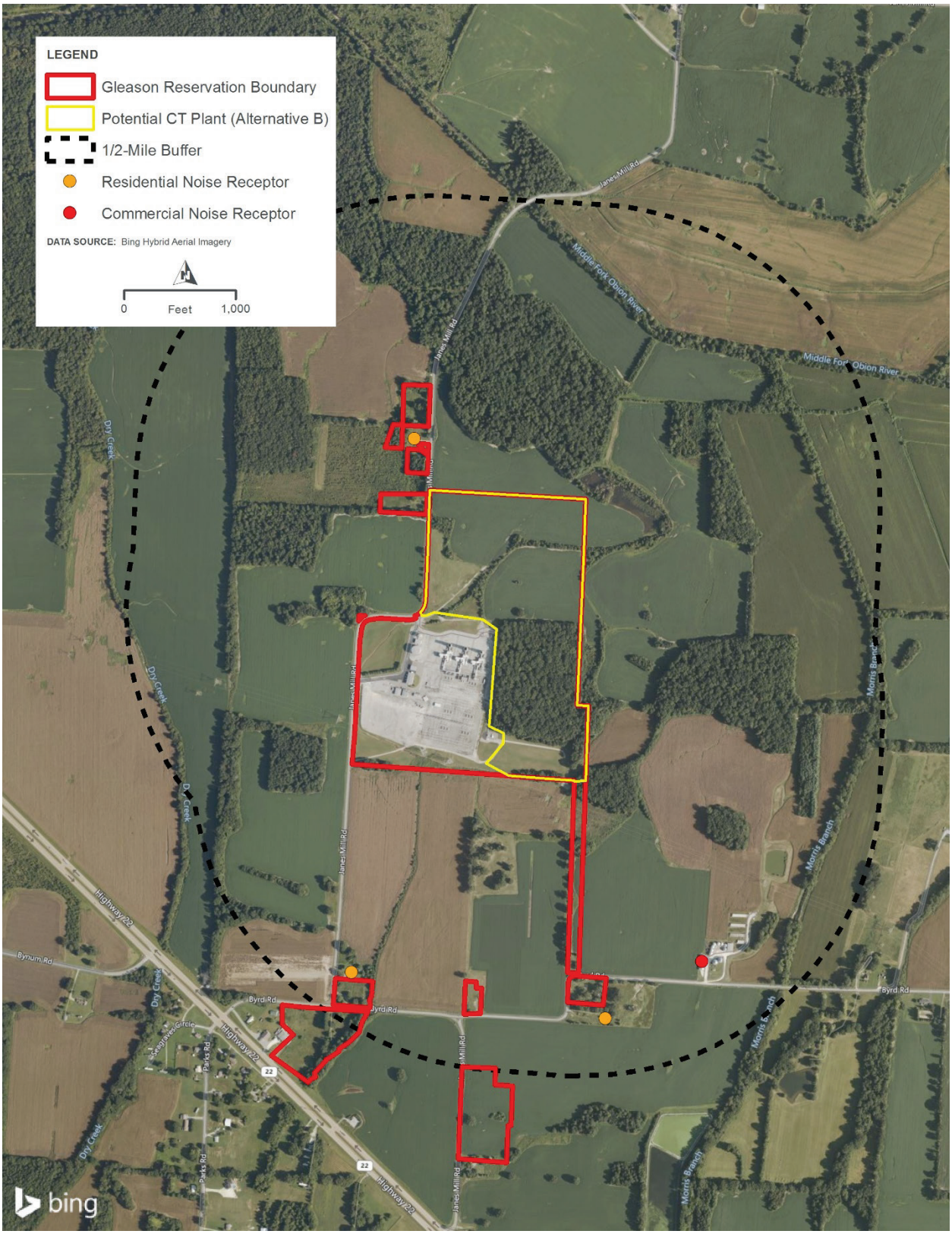

Figure 3.17-3. Noise Receptors within 0.5 mile of the proposed CT plant site within the Gleason Reservation

3.17.2.3.3. Transmission Corridors

Land use in the vicinity of the proposed new 40-mile TL is largely agricultural with smaller portions of forested area. The proposed TL line intersects several small, developed areas, including seven main roadways and multiple smaller rural roads. Therefore, current noise levels in the area are typical for rural areas, with interspersed residential receptors as well as noise from transportation corridors and farm operations.

3.17.2.4. Alternative C

3.17.2.4.1. Middle Tennessee TVA Power Service Area

The proposed solar and storage facilities would likely be located in agricultural, rural, and/or undeveloped areas, largely in Middle Tennessee. Ambient noise in these types of settings typically consist of agricultural sounds, such as noises from farm machinery; natural sounds, such as from wind and wildlife; and moderate traffic sounds. If sites are located in industrial areas or near transportation facilities, the setting may have higher ambient noise levels.

3.17.3. Environmental Consequences

3.17.3.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to operate and maintain the CUF plant. TVA would implement all the planned actions related to the current and future management and storage of CCRs at the coal plants. Under Alternative A, regular operational noise would continue to contribute to daily ambient noise levels.

3.17.3.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

Under all Action Alternatives, TVA would retire, decommission, deactivate, decontaminate, and deconstruct the CUF units and site. Noise effects as a result of these actions would be associated with the removal of equipment and materials onsite, installation of bulkheads and/or fill tunnels, demolition via mechanical deconstruction and/or explosives, and demolition-related traffic to and from the CUF. There are 511 total noise receptors within 0.5 miles of the CUF plant boundary, which largely consist of residences (Table 3.17-1). These receptors would experience temporary noise effects as a result of deconstruction activities.

Noise from demolition, which was assumed to be approximately 94 dB at a 50-foot distance based on blasting levels, would attenuate to 64 dBA at the River Bend Recreation Area, approximately 0.3miles north of the CUF (FHWA 2017).[27] While this level is higher than the EPA noise guidance for Ldn of 55 dBA, it meets the HUD guidelines for Ldn of 65 dBA. Given the temporary and intermittent nature of demolition noise, the effect of noise generated is expected to be minor. Noise effects from demolition-related traffic are expected to be minor as construction related traffic would utilize interstate highways or major arterial roadways as much as possible and likely would not have a noticeable increase on traffic volume and consequently traffic noise near those major roadways.

Effects from additional vehicular traffic are expected to be minor as the roads within the plant are already predominately used by employees and for industrial activity. This small increase in

[27] $Lp(R2) = Lp(R1) - 20 \cdot Log_{10}(R2/R1)$
Where:
Lp(R1) = Known sound pressure level at the first location
Lp(R2) = Unknown sound pressure level at the second location
R1 = Distance from the noise source to location of known sound pressure level
R2 = Distance from noise source to the second location

noise would be temporary and intermittent and only last until construction activities have been completed. Therefore, the increase in current noise levels is estimated to be less than 3 dBA and as such traffic noise is not anticipated to increase perceptibly.

In addition, vibrations associated with explosives would also occur. Vibrations from explosive demolition events can potentially affect nearby structures. Seismologic analyses carried out at recent demolitions of other tall industrial chimneys in the United States strongly suggest that the vibrations would not result in measurable effects on nearby structures (Protec 2008, 2009, and 2013). These seismological analyses were conducted to measure the effects from demolition-related vibrations on standing structures in the vicinity of the chimney demolitions. In each case, vibrations were below the recommended limits set by the U.S. Bureau of Mines Report (Siskind et al. 1980). The report authors in each case concluded the demolitions would not cause damage to structures within the radius of influence. Vibrations resulting from the demolition of the CUF structures would be of similar magnitude. The use of BMPs such as wetting down the structure prior to felling, use of misting systems during stack felling, and use of berms during demolition could also serve as a form of noise/vibration control. Therefore, no damage to structures is anticipated. Due to the temporary nature of the operation, noise and vibration effects on the environment are expected to be minor and temporary.

Projects in vicinity to the D4 activities, such as the CCR management activities, could create short-term, cumulative increases in construction and traffic noise in the area.

3.17.3.2.1. Environmental Justice Considerations

CUF retirement and D4 activities would increase the noise effects on local populations, both EJ and non-EJ. Given the prominence of EJ populations near the CUF Reservation, these effects would generally be experienced by EJ populations more than other populations. While they would be mitigated as much as feasible, given their location in EJ areas, these noise effects have the potential to be amplified on EJ populations.

3.17.3.3. Alternative A

3.17.3.3.1. Construction and Operation of CC Plant at CUF

Noise effects under this alternative would be associated with closure of the CUF units as detailed in Section 3.17.2.2, construction and operation of the CC plant, construction of a new switchyard and connecting two existing 500-kV TLs, and construction-related traffic (construction workforce and the shipment of goods and equipment) to and from the CC plant site.

Burns & McDonnell performed predictive sound modeling for the Project operation using computer aided noise abatement. Based on this study, the Project is expected to contribute a maximum absolute sound level of approximately 52 dBA at MP01 and 69 dBA at MP02. MP01 is located in the vicinity of the Hollister House, and MP02 is located at the southwest corner of the Project site (Appendix N). Therefore, noise levels at the Henry Hollister House would likely reach the same maximum of 69 dBA as predicted for MP02 during plant operations.

There are 511 total noise receptors within 0.5 mi of the CUF plant boundary, which largely consist of residences (Table 3.17-1). These receptors would experience temporary noise effects as a result of CC plant construction activities.

Typical noise levels from construction equipment used at the CUF for CC plant construction and operation are expected to be 85 dBA or less at a distance of 50 feet from the site (FHWA 2017). The nearest residence, the Henry Hollister House, is located within/directly adjacent to the CC

plant site (Section 3.13.2). Therefore, noise levels at the Henry Hollister House would likely reach the same maximum of 85 dBA during the construction period. This exceeds the EPA noise guidance for Ldn of 55 dBA and the HUD guidelines for Ldn of 65 dBA. Given the temporary and intermittent nature of construction noise, the effect of noise generated from construction of the CC plant is expected to be minor. Noise effects from construction-related traffic are expected to be minor as construction related traffic would utilize rail or barge and likely would not have a noticeable increase on traffic volume and consequently traffic noise near major roadways.

Effects from additional vehicular traffic are expected to be minor as the roads within the plant are already predominately used by employees and for industrial activity. This small increase in noise would be temporary and intermittent and only last until construction activities have been completed. Construction is anticipated to occur over a period of approximately 3 years and would occur during daytime hours, typically during the weekdays but with potential weekend and night-time work on a limited basis. Therefore, the increase in current noise levels is estimated to be less than 3 dBA and as such traffic noise is not anticipated to increase perceptibly.

The six miles of OPGW would be installed via helicopter along an existing TL. Using this method, one reel of OPGW would be installed approximately every two working days, weather permitting, and should be completed during a two-week period. A temporary noise disturbance would result in nearby communities due to the use of a helicopter (105 dB).

Projects in vicinity to the proposed CC plant, such as the CCR management activities, could create short-term, cumulative increases in construction and traffic noise in the area.

3.17.3.3.2. Construction and Operation of Natural Gas Pipeline

Noise effects would be a result of the construction of the gas system infrastructure on the CUF site to connect the plant to the new pipeline, the excavation and laying of the pipeline, and construction-related traffic (construction workforce and the shipment of goods and equipment) to and from the pipeline corridor.

Typical equipment used to construct and operate the pipeline would consist of trucks, cranes, rollers, bulldozers, pickup trucks, and backhoes. Typical noise levels from construction equipment used along the corridor are expected to be 85 dBA or less at a distance of 50 feet from the corridor (TGP 2022i). “People at nearby residences and buildings may hear the construction noise, but the overall impact would be short-lived and insignificant” (TGP 2022i). The pressure regulation station site is within 40 feet of a residence and close to multiple other residences; however, the immediate area surrounding the site is composed of mature forest that would provide existing noise buffer of the facility. “Construction would not result in the generation of, or exposure of persons to excessive noise or vibration levels for lengthy periods” (TGP 2022i).

Kinder Morgan conducted an analysis on the cumulative acoustical impact of HDD operations on identified representative receptors (Table 3.17-4) using Computer Aided Noise Abatement (“CADNA/A”) acoustic modeling software (Version 2021 MR2) published by Datakustik GmbH, configured to implement ISO-9613-2 environmental noise propagation algorithms. This model includes geometrical divergence (distance attenuation), barrier effects due to intervening structures, ground effects, atmospheric absorption, and topography. A summary of acoustic parameters used as inputs for the CADNA/A acoustic model for the project are summarized in Table 3.17-6.

Table 3.17-6. Key Acoustic Modeling Parameters

Parameter	Value	Rationale
Ground Absorption	0	For waterbodies
Ground Absorption	0.2	Accounts for mostly acoustically
Ground Absorption	0.8	Accounts for mostly acoustically
Temperature	50°F	Assumed standard weather
Relative Humidity	70%	Assumed standard weather
Maximum Order of Reflection	2	Accounts for building reflections

Source: TGP 2022i

A summary of the sound power ratings for anticipated equipment at the HDD entry pit is provided in Table 3.17-7. A summary of the sound power ratings for equipment at the exit pit is summarized in Table 3.17-8.

Table 3.17-7. Combined Equipment Sound Power at HDD Entry Pit

Equipment	Assumed Quantity Operating Simultaneously	Maximum Sound Power Level of Equipment
HDD Drilling Rig[1]	1	104
Mud Pump Engines[1]	1	112
Mud Cleaner	1	102
Shaker	1	108
Bentonite Mixer[1]	1	92
Excavator[2]	1	110
	Total Sound Power Level	116

[1]Sound power based on previous experience
[2] U.S. Department of Transportation, Federal Highway Administration. 2011. FHWA Highway Construction Noise Handbook. Available online at: http://www.fhwa.dot.gov/environment/noise/handbook/09.htm
Source: TGP 2022i

Table 3.17-8. Combined Equipment Sound Power at HDD Exit Pit

Equipment	Assumed Quantity Operating Simultaneously	Maximum Sound Power Level of Equipment
HDD Drilling Rig[1]	1	104
Mud Pump Engines[1]	1	112
Bentonite Mixer[1]	1	92
Excavator[2]	1	110
	Total Sound Power Level	111

[1]Sound power based on previous experience
[2] U.S. Department of Transportation, Federal Highway Administration. 2011. FHWA Highway Construction Noise Handbook. Available online at: http://www.fhwa.dot.gov/environment/noise/handbook/09.htm
Source: TGP 2022i

As stated in in Resource Report 9 (TGP 2022i):

> Construction noise, while varying according to equipment in use, will be mitigated by the attenuating effect of distance and the intermittent and short-lived character of the noise. Given that diesel engine exhaust noise is a major component of construction equipment noise, functional mufflers will be maintained on all equipment in order to minimize construction noise levels.

All pipeline and associated pipeline facility construction activities, with the exception of some work (i.e., HDD), would be limited to normal working hours (7:00 am–7:00 pm) and Monday through Saturday (TGP 2022i). While most of the HDD activities would occur during normal working hours, the actual drilling activity, once begun, would occur continuously until completed aside from unexpected weather events or other impediments to safe working conditions.

As detailed in Resource Report 9 (TGP 2022i):

> Some discrete activities (e.g., hydrostatic testing, tie-ins, purge and packing the pipeline, etc.) may require 24-hour activity for limited periods of time (e.g., one to three days). These 24-hour activities require only a few overnight construction personnel and will have an insignificant noise impact on nearby NSAs. Any controlled blasting that may be used to remove rock will be limited to daytime hours only and will be done in compliance with applicable federal, state, and local regulations; permit conditions; and contract conditions with the construction and blasting contractors.

Without specific noise mitigation measures, the modeled noise levels resulting from HDD would exceed the FERC criteria of 55 dBA at five of 11 NSAs, including at least one NSA at each HDD location. Table 3.17-9. provides a summary of the modelled noise contribution of HDD operations for the planned HDD sites based on the modelled sound level contribution of the HDD operations and other designated noise receptors and the ambient sound level at the closest NSA(s) to the HDD construction sites.

Table 3.17-9. Estimated Unmitigated Noise Impact due to HDDs (Bolded items exceed FERC criteria of 55 dBA)

HDD	NSA	Ambient Sound Levels (dBA)	Construction Noise Impact (dBA)	Cumulative Noise Impact (dBA)1	FERC Criteria (dBA)
		Ldn	Ldn	Ldn	Ldn
HDD #1 - Jones Creek (MP 3.0)	NSA01	34	55	**56**	55
	NSA02	34	53	53	55
	NSA03	34	51	51	55
HDD #2 - Yellow Creek (MP 12.0)	NSA04	38	**60**	**60**	55
	NSA05	38	**56**	**56**	55
	NSA06	38	**57**	**57**	55
	NSA07	38	**58**	**59**	55
	NSA08	38	51	51	55

HDD	NSA	Ambient Sound Levels (dBA)	Construction Noise Impact (dBA)	Cumulative Noise Impact (dBA)1	FERC Criteria (dBA)
HDD #3 - Wells Creek (MP 30.0)	NSA09	38	48	49	55
	NSA10	38[28]	47	48	55
	NSA11	38[29]	49	50	55

Source: TGP 2022i

TGP has identified potential noise mitigation measures for the Jones Creek HDD #1 and Yellow Creek HDD #2 drilling sites. At the HDD #1 site, noise could be mitigated by instituting work practices such as reduced idling and fitting equipment with residential mufflers (TGP 2022i). At the HDD #2 site, noise could be mitigated by instituting work practices such as reduced idling and fitting equipment with residential mufflers as well as installing sound barrier walls between the HDD entry pit and the NSAs (TGP 2022i). These mitigation measures would reduce the modeled noise level at HDD #1 NSA01 from 56 to 55 dBA. The noise levels at HDD #1 NSA02 and NSA03 would not change. The mitigation measures at HDD #2 would reduce the noise levels at NSA04, NSA05, NSA06, and NSA07 to between 51 and 53 dBA. With implementation of these mitigation measures, modeled noise levels at NSAs in the vicinity of the HDD sites would not exceed the FERC standard of 55 dBA (TGP 2022i). “Further, TGP will provide advanced notification to nearby NSAs for any planned nighttime HDD construction activities. TGP will implement recommended mitigation measures as listed in [TGP Resource Report] Table 9.3-7, and then offer temporary relocation for residents in the event that the recommended noise mitigation measures do not resolve noise concerns raised by nearby residents” (TGP 2022i). Because of the temporary nature of the construction noise during normal installation of the pipeline along the pipeline route, no adverse or long-term effects are anticipated.

Onsite noise generating equipment has been conservatively estimated. The noise impact of installed onsite equipment will be less than or equal to the modelled impact. Mitigation measures will limit the maximum noise levels to 90 dBA at the pressure regulation station during construction activities (MP 0.0) (TGP 2022i). “Components of the noise mitigation measures to be implemented will depend on feasibility, site constraints, and cost” (TGP 2022i).

Table 3.17-10 provides a summary of the noise impact during operation of the new aboveground facilities. According to TGP’s Resource Report 9 (TGP 2022i):

> The projected sound levels include the estimated sound level of the pressure regulation station and Cumberland Meter Station during operation inclusive of the current ambient sound levels. […] A combination of noise controls including piping insulation, burying of pipe, alternative piping design, installation of a pressure control valve with low noise trim, and/or the installation of a noise mitigating structure such as enclosure may be installed to achieve the required sound power level.

[28] Ambient sound level measurements were not collected at NSAs in proximity to HDD #3 as NSAs are further than 0.5 miles from the HDD entry and exit pits. Measurements taken at NSAs in proximity to HDD #2 are considered representative of the ambient environment for NSAs at HDD #3

[29] See ref. 22

Table 3.17-10. Noise Impact for Pressure Regulation Station and the Cumberland Meter Station

Regulator Station and Meter Station and Closest NSA(s)	Distance and Direction of the Closest NSA(s)	Current (Ambient) Ldn (dBA)[30]	Estimated Ldn due only to Facility after Modifications (dBA)	Facility Ldn including Existing Ldn (dBA)	Applicable Criteria Ldn (dBA)
Pressure Regulation Station (MP 0.0)	360 feet (N)	38.5	45.7	46	55
	530 feet (S)	41	43.4	45	55
Cumberland Meter Station (MP 31.5)	2,800 feet (NNW)	48.7	37	49	55

Source: TGP 2022i

TGP states (TGP 2022i):

> TGP will take steps to minimize the impact of vibration, where possible, on nearby residences. TGP will inform nearby residents of the [pipeline corridor] and the upcoming construction activities, including HDD operation and will respond and investigate concerns. Excavators and other heavy equipment must be used more than 50 feet from existing building structures, where possible. TGP's contractor will route heavily loaded trucks and equipment away from residential streets and vibration-sensitive sites, where possible. TGP's contractor will sequence phases of construction activities such as earth-moving and ground impacting so as not to occur in the same time period and avoid nighttime activity.
>
> Vibration levels are highly dependent on equipment models, modes of operation, and local ground conditions. TGP's contractor will monitor vibration levels at existing building structures if the 50-foot setback distances cannot be maintained due to site constraints.

3.17.3.3.3. Summary of Alternative A

In sum, the majority of noise disturbances would occur during construction of Alternative A components. Typical noise levels from construction equipment used for CC plant and pipeline construction and operation are expected to be 85 dBA or less at a distance of 50 feet from the site (FHWA 2017). The increase in current noise levels is estimated to be less than 3 dBA. Construction would not result in the generation of, or exposure of persons to excessive noise or vibration levels for lengthy periods, and noise mitigation efforts will be implemented by both TVA and TGP (TGP 2022i).

[30] Current ("pre-existing") sound level (Ldn) at the NSA based on type of land area and current environmental activities

3.14.1.1.1 Environmental Justice Considerations

Pipeline construction activities would increase the noise effects on local populations, both EJ and non-EJ. Given the prominence of EJ populations near the CC plant location and in the pipeline corridor, these effects would generally be experienced by EJ populations more than other populations. In regard to the pipeline, some of the loudest activities and components are located in EJ areas. Pipeline-related noisy activities and components in EJ areas include the HDD locations and the Cumberland Meter Station, located at the western end of the pipeline corridor, at the CC plant location. While these effects would be mitigated as much as feasible, the noise effects associated with Alternative A have the potential to be amplified on EJ populations given the location of some of these activities in EJ areas.

3.17.3.4. Alternative B

3.17.3.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

Noise effects under this alternative would be associated with closure of the CUF units as detailed in Section 3.17.2.2, construction and operation of a CT plant at JCT Reservation, construction of a 40-mile TL, and construction-related traffic (construction workforce and the shipment of goods and equipment) to and from the JCT. The proposed construction would occur within an existing developed area of the JCT. Typical equipment used during the construction phase would consist of trucks, truck-mounted augers and drills, excavators, as well as tracked cranes and bulldozers (Table 3.3-1). Typical noise levels from construction equipment are expected to be 85 dBA or less at a distance of 50 feet from the site (FHWA 2017). Given the existing industrial nature of this site and lack of nearby residential noise receptors, there would be minimal direct noise effects associated with the proposed construction and operation of a CT plant at JCT.

Transportation of workers and materials would utilize nearby roadways, as described in the Transportation section. The haul route has not yet been determined, but noise effects may occur to noise receptors within 500 feet of the roadways used on the haul route during construction. Construction is anticipated to occur over a period of three years and would occur during daytime hours, typically during the weekdays but with the potential for weekend and night-time work on a limited basis. Given the temporary and intermittent nature of construction noise, the effect of noise generated from construction is expected to be minor. Noise effects from construction-related traffic are expected to be minor as construction related traffic would utilize rail as much as possible and likely would not have a noticeable increase on traffic volume and consequently traffic noise near major roadways.

Although there are no recent noise measurements at JCT, measurements at other TVA plants (e.g., Paradise (TVA 2021f)) show on-site noise levels of 59 to 78 dBA. The increase in overall noise levels after construction is estimated to be less than 3 dBA during operations and traffic noise is not anticipated to increase perceptibly. RFFAs in vicinity to the proposed CT plant, such as the JCT Aeroderivative plant, could create short-term, cumulative increases in construction and traffic noise in the area.

3.17.3.4.2. Construction and Operation of CT Plant at Gleason Reservation

Noise effects related to the construction of the CT plant at the Gleason Reservation would be comparable to those described in Section 3.17.3.4.1 for the JCT. A CT plant is currently operating on the Gleason Reservation; however, the proposed new CT plant would be constructed on undeveloped land adjacent to the existing CT plant. There are only four total noise receptors within a 0.5 mi-radius of the plant site, including one commercial property and three residences (Table 3.17-5). These receptors would experience temporary noise effects as

a result of construction activities. Due to the temporary and intermittent nature of construction noise, the effect of noise generated from operation is expected to be minor.

Noise effects from construction-related traffic are expected to be minor as construction related traffic would utilize interstate highways and major arterial roadways as much as possible and likely would not have a noticeable increase on traffic volume and consequently traffic noise near those major roadways. Based on the absence of RFFAs near the proposed CT plant, no cumulative increases in construction and traffic noise are expected in the area.

3.17.3.4.3. Transmission and Other Components

Construction of the 40-mile 500 kV TL would result in temporary, minor noise effects related to construction and construction-related traffic. After the construction of the TL, there would not be significant continued noise as a result of its operation aside from occasional maintenance activities.

3.17.3.4.4. Environmental Justice Considerations

Noise-related effects from construction of the CT facility would be short-term, localized, and minor. While there are no EJ populations in the immediate vicinity of the Gleason Reservation, EJ populations are present near JCT. Therefore, these short-term negative conditions could be amplified on EJ populations, given their proximity to JCT.

RFFAs in vicinity to the proposed CT plant, such as the JCT Aeroderivative plant, could create short-term, cumulative increases in construction and traffic noise in the area if this project occurs at the same time as implementation of Alternative B. This could increase the noise effects on EJ populations in the JCT vicinity.

3.17.3.5. Alternative C

3.17.3.5.1. Construction and Operation of Solar and Storage Facilities

Typical direct and indirect noise effects associated with solar and storage facilities would primarily occur during construction. Construction equipment produces a range of sounds while operational. Noisy construction equipment, such as delivery trucks, dump trucks, water trucks, service trucks, bulldozers, chain saws, bush hogs, or other large mowers for tree clearing, produce maximum noise levels at 50 feet of approximately 84 to 85 dBA. Construction noise would likely cause temporary and minor adverse effects to the ambient sound environment around each project site. Nearby noise receptors would temporarily experience heightened noise during construction, primarily from pile-driving activities. If the site is located near commercial operations or agricultural complexes, these facilities likely produce ambient sounds that are at or higher than the typical 45 to 55 dBA, and these existing noises would help lessen effects from the construction of solar and storage facilities. Additionally, construction would primarily occur during daylight hours, between sunrise and sunset; therefore, project construction would not affect ambient noise levels at night during most of the construction period. Most of the proposed equipment would not be operating on site for the entire construction period but would be phased in and out according to the progress of the projects.

The activity likely to make the most noise for an extended time period would be pile driving during the construction of the solar array foundations. Standard construction pile drivers are estimated to produce between 90 to 95 dBA at a distance of 50 feet (FHWA 2011). Following completion of construction activities, the ambient sound environment on and surrounding the solar or storage facility sites would be expected to return to existing levels. The moving parts of the PV arrays would be electric-powered and produce little noise. The central inverters associated with solar sites would produce noise levels of approximately 65 dBA at 33 feet, and

substations typically emit approximately 50 dBA at 300 feet. For storage facility sites, the average sound level is less than 82 dB from 10 feet surrounding the onsite transformers.

The periodic mowing of solar sites to manage the height of vegetation surrounding the solar panels would produce sound levels comparable to those of agricultural operations. Overall, Alternative C would likely result in minor, temporary adverse effects to the ambient noise environment during construction, and minimal to negligible effects during operation and maintenance of the solar facility. Detailed analyses of noise effects would occur for each solar and storage facility under future NEPA reviews.

Cumulative effects would also occur if Alternative C was combined with the 10,000 MW expansion of solar planned in the 2019 TVA IRP, which could create short-term, cumulative increases in construction and traffic noise in the region.

3.17.3.5.2. Transmission and Other Components

Construction of transmission lines and transmission line upgrades associated with solar and BESS sites would result in temporary, minor noise effects related to construction and construction-related traffic. After the construction of the TLs, there would not be significant continued noise as a result of its operation aside from occasional maintenance activities.

3.18. Visual Resources

3.18.1. Affected Environment

Visual resources compose the visible character of a place and include both natural and human-made attributes. Visual resources influence how an observer experiences a particular location and distinguishes it from other locations. Such resources are important to people living in or traveling through an area and can be an essential component of historically and culturally significant settings. The visual classification criteria used in this analysis are adapted from a scenic management system developed by the U.S. Forest Service (USFS) and integrated with planning methods used by TVA (USFS 1995). Potential visual effects to cultural and historic resources are not included in this analysis as they are assessed separately in Section 3.9.

The subjective perceptions of a landscape's aesthetic quality and sense of place is dependent on where and how they are viewed. Views of the landscape are described in terms of what is seen in the foreground (within 0.5 miles), middleground (0.5-4 miles), and background (4-10 miles) distances. The resulting scenic value class of a landscape is determined by combining the levels of scenic attractiveness, scenic integrity, and visibility. Scenic attractiveness is a measure of the scenic beauty of a landscape and is based on perceptions of the visual appeal of landforms, waterways, vegetation, and the human-built environment. Scenic attractiveness is assessed as either distinctive, typical/common, or indistinctive. As adapted for this analysis, scenic integrity measures the degree of visual unity of the natural and cultural character of the landscape. Scenic integrity is evaluated as either low, moderate, or high.

3.18.1.1. CUF Reservation

The topography surrounding CUF ranges from relatively flat near the banks of the Cumberland River to moderately sloping in the western portion of the reservation. Industrial activities to the southeast are largely obstructed from view by forested buffer areas surrounding the plant. Cumberland City, a small residential area, exists to the east of the project area on the other side of Old Hwy 149. Night lighting is widespread at CUF and the nearby industrial plants.

Except for CUF and the other industrial plants to the southeast, the surrounding region is largely undeveloped with residential and commercial development in the vicinity of Cumberland City to the east and Erin to the south. Components of the existing CUF site are dominant elements in the landscape and include the two-unit plant, gypsum complex, the two 630-foot-high emissions stacks, and the two 1,000-foot high emissions stacks (Figure 3.18-1 and Figure 3.18-2). Water vapor emitted by the stacks is also a prominent visual element during much of the time the plant is operating. Much of the area around the coal plant buildings is devoid of any vegetation, although there are some small patches of lawn and trees along roadways and forested areas on the perimeter (Figure 3.18-3).

The viewscape of the coal plant facility includes broadly horizontal buildings and industrial equipment and the four emissions stacks. Therefore, scenic attractiveness of these areas are minimal and scenic integrity ranges from low to very low. Scenic attractiveness of the area is considered common, and scenic integrity is considered moderate due to human alteration in the area. The ratings for scenic attractiveness assigned to the project sites are due to the ordinary or common visual quality. The forms, colors and textures in the affected environment are normally seen through the characteristic landscape and are not considered to have distinctive quality. In the foreground and middleground, the scenic integrity has been lowered by slight human alteration such as residential and industrial development. However, in the background these alterations are not substantive enough to dominate the view of the landscape. Based on the criteria used for this analysis, the overall scenic value class for the affected environment ranges from poor within the plant facility to good in the surrounding area.

Figure 3.18-1. View from the Southwest of the CUF

Figure 3.18-2. View of CUF and surrounding land

Figure 3.18-3. Aerial view towards the south of CUF Reservation and surrounding area showing the Plant, the switchyard, permitted CCR units, and process water basin

3.18.1.2. Alternative A

3.18.1.2.1. Proposed CC Plant Site

To the south of the existing coal facility, the CUF Reservation consists of undeveloped land, including fields and forested areas. The proposed CC plant site is an area of common scenic attractiveness, as the site contains viewscapes comparable to the surrounding land use. The scenic integrity of this portion of the reservation is low to moderate in that the viewscape is interrupted by industrial elements associated with the existing coal plant and transmission infrastructure. The total number of visual receptors, which are receptors within the line of sight of the source, within 0.5 mile of CUF and their classifications can be seen in Table 3.18-1 and Figure 3.18-4. Some of the receptors identified within this section may be out of the line of sight due to changes in vegetation, air quality, or angles that were not accounted for in this analysis.

Table 3.18-1. Visual receptors within 0.5-mile of the Proposed CC Plant and the Cumberland Reservation

Visual Receptor Type	Alternative A CC Plant
Commercial	93
Farm building	22
Industrial	11
Residential	380
Vacant	4
Unknown	1
Total	**511**

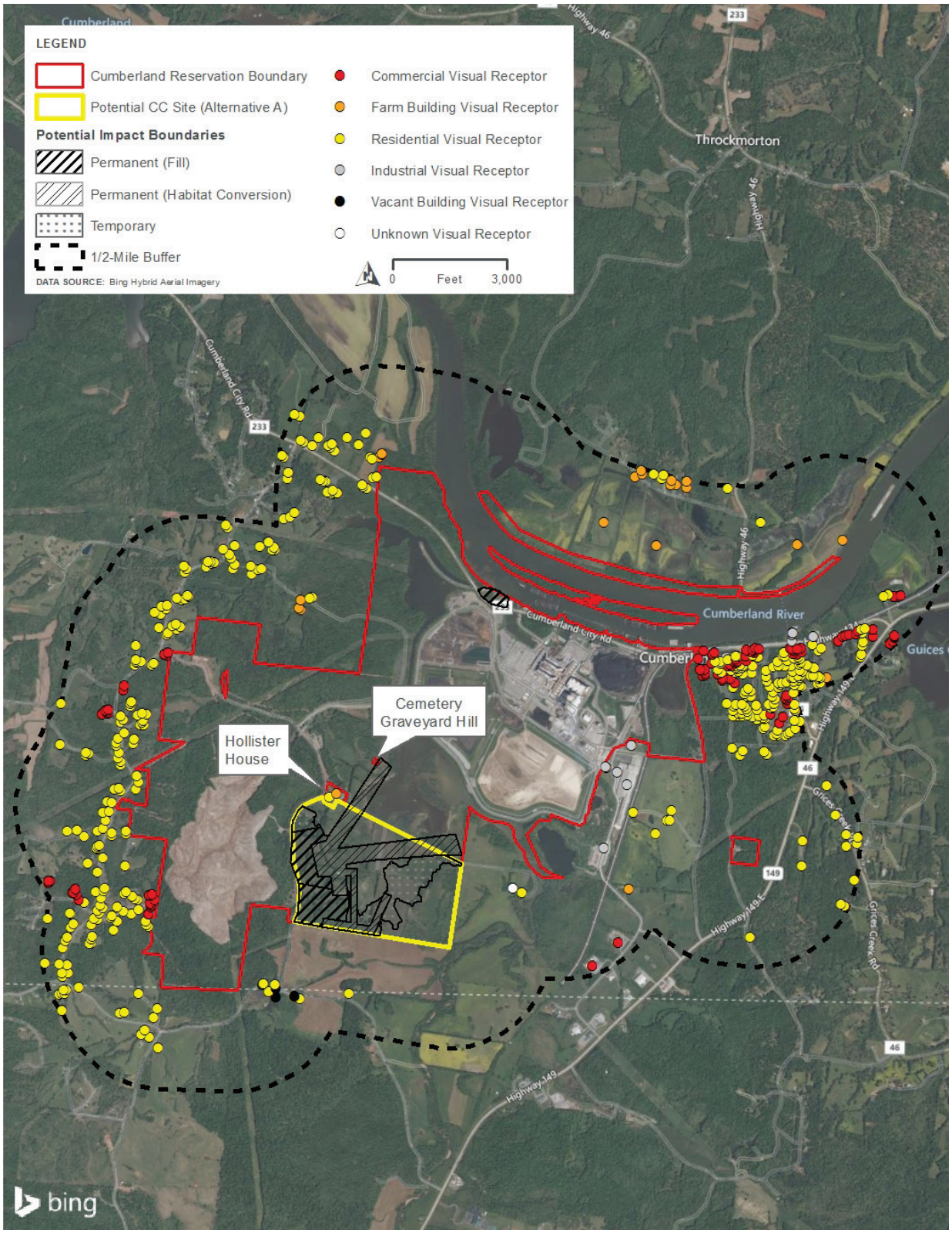

Figure 3.18-4. Visual receptors within 0.5-mile of the Proposed CC Plant and the Cumberland Reservation

3.18.1.2.2. Natural Gas Pipeline Corridor

Industrial activities associated with CUF are visible from the western origin point of the corridor. Cleared open space associated with the existing TVA TL ROW would be seen across the length of the pipeline corridor, largely buffered by surrounding forest. Traffic and low-density residential areas can be seen in areas where the corridor crosses or comes near roadways, particularly near Highway 149, TN-13, Highway 235, TN-49, and Highway 250.

The affected environment includes the pipeline corridor as well as the physical and natural features of the landscape. The proposed pipeline begins near Ashland City, Tennessee, then continues northwest for 32 miles, terminating at the southern border of CUF. Land use in the pipeline corridor consists of forest lands and pastureland. The viewscape of the corridor is largely pre-disturbed open space, elements associated with the TL, and forest buffering the TL corridor. Scenic attractiveness of the area is considered common, and scenic integrity is considered moderate due to human alteration in the surrounding area. The ratings for scenic attractiveness assigned to the corridor ROW are due to the ordinary or common visual quality. The forms, colors and textures in the affected environment are normally seen through the characteristic landscape and are not considered to have distinctive quality. In the foreground and middleground, the scenic integrity has been lowered by slight human alteration such as residential and commercial development. However, in the background these alterations are not substantive enough to dominate the view of the landscape. The total number of visual receptors within 0.5 mile of the pipeline corridor and their classifications can be seen in Table 3.18-2 and Figure 3.18-5.

Table 3.18-2. Visual receptors within 0.5-mile of the Alternative A natural gas pipeline

Visual Receptor Type	Alt A – Pipeline
Commercial	38
Residential	659
Church	3
School	3
Sports field	2
Vacant	606
Unknown	204
Total	**1515**

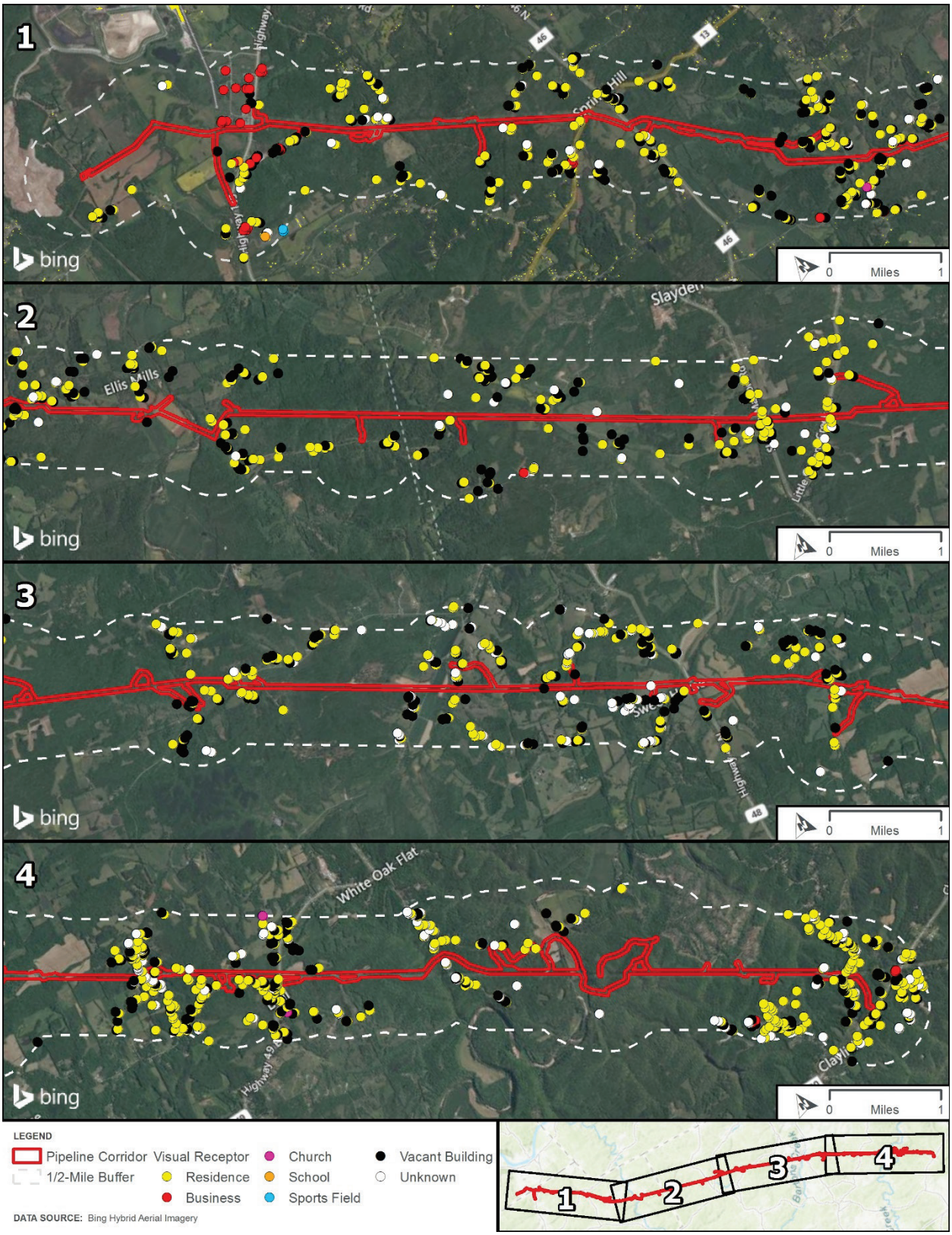

Figure 3.18-5. Visual Receptors within 0.5-mile of the Alternative A Gas Pipeline

3.18.1.3. Alternative B

3.18.1.3.1. Johnsonville Reservation

The surrounding topography ranges from relatively flat near the banks of the Tennessee River (Kentucky Reservoir) to moderately sloping at Johnsonville State Historic Park to the north. Industrial activities to the north are visible from the project area. Forested areas within Johnsonville State Historic Park are visible to the east and northeast. Low-density residential areas exist to the west of the project area across the Tennessee River (Kentucky Reservoir) and there is residential development south of the site. The proposed CT plant would be constructed on a previously developed area. Components of the retired power plant remain dominant elements in the landscape; however, these components are currently being demolished. Other major visual components of the industrial site include TLs and associated structures, existing CTs (CT 17 through CT 20) already operating on site, and ten new Aeroderivative CTs currently being constructed on the site. Parts of the reservation are illuminated at night, as are the nearby industrial facilities. Much of the proposed CTC plant site is devoid of vegetation. Scenic attractiveness of these areas is minimal and scenic integrity ranges from low to very low.

Except for the retired Johnsonville coal plant and other industrial uses to the north, much of the surrounding region is largely undeveloped aside from residential and commercial development in the vicinity of New Johnsonville and along the major roadways. Scenic attractiveness of the area is considered common, and scenic integrity is considered moderate due to human alteration in the surrounding area. The ratings for scenic attractiveness assigned to the project sites are due to the ordinary or common visual quality. The forms, colors and textures in the affected environment are normally seen through the characteristic landscape and are not considered to have distinctive quality. In the foreground and middleground of the CT plant site, the scenic integrity has been lowered by extensive human alteration through industrial development. However, in the background these alterations are not substantive enough to dominate the view of the landscape. Based on the criteria used for this analysis, the overall scenic value class for the affected environment ranges from poor within the proposed plant facility to good in the surrounding project area.

The only visual receptors within 0.5 mile of the project area are industrial facilities, which are not considered sensitive receptors. These sites can be seen in Figure 3.18-6.

Figure 3.18-6. Visual Receptors within 0.5-mile of the Proposed CT Plant and the Johnsonville Reservation

3.18.1.3.2. Gleason Reservation

Flat, rural landscapes and power lines are visible in the area surrounding the Gleason Reservation. Small patches of forested area and tree lines are visible between agricultural fields. A few residences are scattered across the landscape to the north of Highway 22, with density increasing to the south of Highway 22 as proximity to the town of Gleason increases. The affected environment includes the existing CT plant site and associated roads, as well as the physical and natural features of the landscape. Except for the existing Gleason plant, the surrounding region is largely undeveloped with agricultural fields and forested areas, and residential and commercial development in the vicinity of Gleason. Components of the existing CT plant are dominant elements in the landscape and include the three generating units and powerlines. The existing CT plant is illuminated at night.

Scenic attractiveness of the area is considered common, and scenic integrity is considered moderate due to expansive agricultural fields with roads, scattered residences, and the Gleason Reservation. The ratings for scenic attractiveness assigned to the project sites are due to the ordinary or common visual quality. The forms, colors and textures in the affected environment are normally seen through the characteristic landscape and are not considered to have distinctive quality. In the foreground and middleground, the scenic integrity has been lowered by slight human alteration such as residential and industrial development. However, in the background these alterations are not substantive enough to dominate the view of the landscape. One commercial development and three residences, all potential visual receptors, are located with 0.5 mile of the Gleason site (Figure 3.18-7).

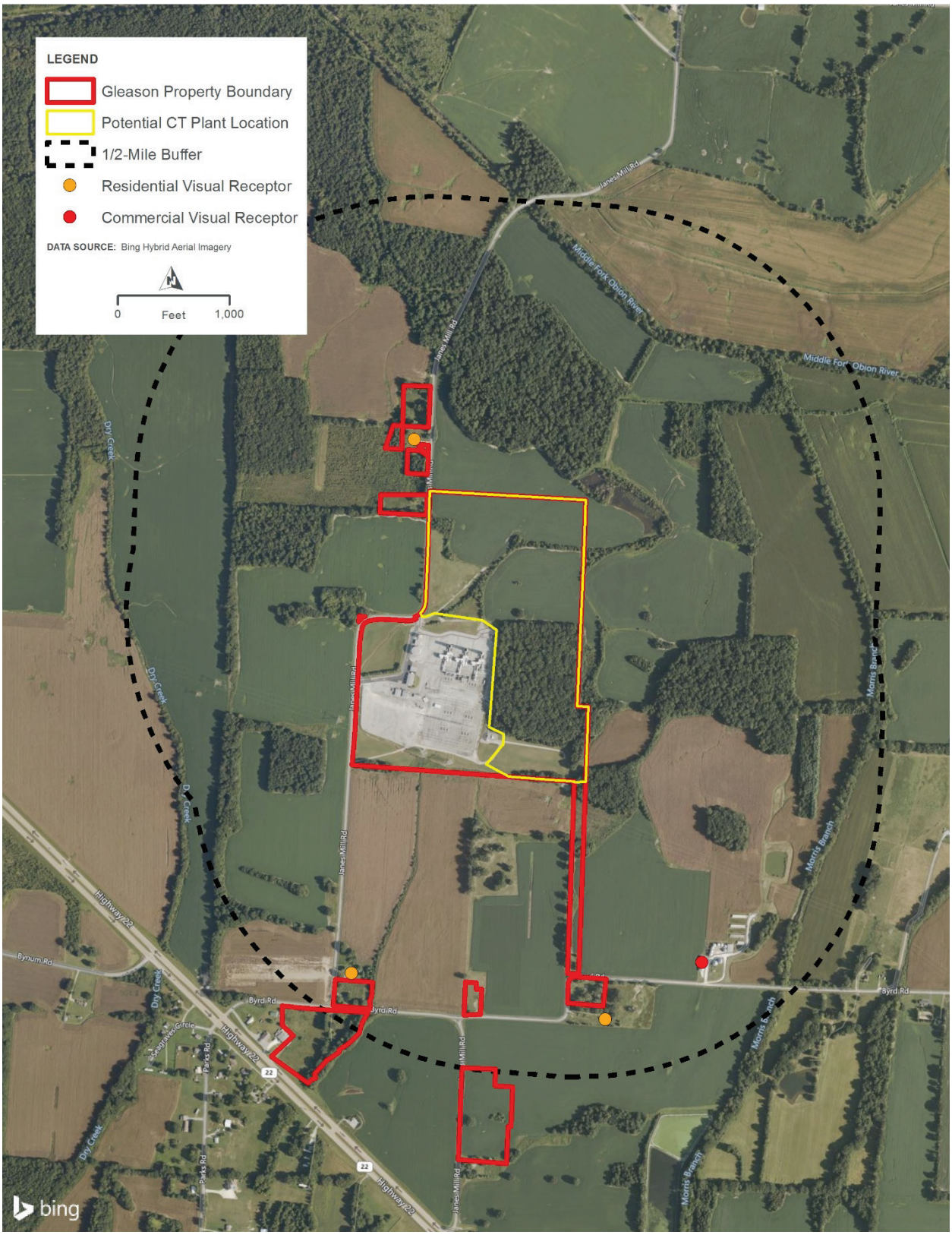

Figure 3.18-7. Visual Receptors within 0.5-mile of the Proposed CT Plant and the Gleason Reservation

3.18.1.3.3. Transmission Corridors

Land use in the area of the proposed 40-mile, 500-kV TL is largely agricultural with smaller portions of forested area. The proposed TL line intersects a few developed areas, including seven main roadways and multiple smaller rural roads. The viewscape in the corridor is typical for rural areas, with interspersed residential receptors as well as transportation corridors.

Scenic attractiveness of the area is considered common, and scenic integrity is considered moderate due to human alteration in the surrounding area. Detailed analyses of visual resources would be conducted under supplemental NEPA reviews if Alternative B is selected as the preferred alternative.

3.18.1.4. Alternative C

3.18.1.4.1. Middle Tennessee TVA Power Service Area

Middle Tennessee Solar and storage facilities sites would likely be located in agricultural, rural, undeveloped areas, or some combination, largely in Middle Tennessee, with common scenic attractiveness and varying levels of scenic integrity. The affected environment of visual resources would be studied for each solar and storage facility under future NEPA reviews.

3.18.2. Environmental Consequences

3.18.2.1. The No Action Alternative

Under the No Action Alternative, TVA would continue to operate the CUF plant. TVA would implement all the planned actions related to the current and future management and storage of CCRs at the fossil plants, which have either been reviewed or will be in subsequent NEPA analysis. Under this alternative, the fossil plant would continue to operate and none of the physical infrastructure currently at the site would change. The primary features in the visual environment, including the stacks, plant buildings, and connecting transmission lines leaving the plant sites, would remain in place. Therefore, the overall scenic value class would remain fair.

3.18.2.2. Retirement, Decommissioning, Deactivation, Decontamination, and Deconstruction of CUF Plant

All buildings, structures, conveyers, and silos associated with plant operations would be decontaminated and demolished to three feet below final grade. All below-grade building areas would be backfilled and the site would be restored to grade, thereby changing the visuals in CUF. Demolition of the four emission stacks would cause a beneficial visual effect to receptors in the foreground, middleground, and background distance. Visibility of the remaining deconstruction actions is expected to be limited to receptors within the middleground and foreground viewing distances due to the screening effect of surrounding topography and vegetation. At the background distance, most of the deconstruction actions are not expected to be discernible due to the screening effects of terrain and overall distance, nor would they contrast with the overall landscape.

In order to mitigate visual effects, TVA would grade and revegetate after deconstruction activities. TVA will maintain the site until it is redeveloped at some time in the future. During the retirement and demolition of CUF, there would be slight visual discord from the existing conditions due to an increase in personnel, cranes, and other tall and colorful equipment in the area. As potential visual disturbances would only be visible to a few people with nearby vantage points, and due to the temporary nature of the activities, visual effects during demolition of the outlying facilities would be considered insignificant.

There would be an increase in vehicular traffic along Cumberland City Road and Old Highway 149 during the hauling of material from CUF, which would be noticeable to residents along those streets. Effects from additional vehicular traffic are expected to be minor as the roads within the plant are already predominately used by employees and for industrial activity. This small increase in visual discord would be temporary and intermittent and only last until construction activities have been completed.

Although many structures would be removed, the closed CUF and remaining operational structures would be visually similar to other industrial elements present in the current landscape with the exception of the removed silos. Therefore, the site would generally be absorbed by surrounding industrial components and would become visually subordinate to the overall landscape character associated with the plant site.

Cumulative effects caused by the retirement of CUF could include the eventual redevelopment of the site, providing a different visual experience for recreational river users, motorists, and area residents. Without knowing what development would occur, the extent or manner of visual effects is not known. However, it would likely result in an improved visual setting and minor cumulative, beneficial effects.

3.18.2.2.1. Environmental Justice Considerations

CUF D4 activities would increase the visual effects on local populations, both EJ and non-EJ. Demolition of the four emission stacks would cause a temporary visual effect at the time of demolition, while an overall beneficial visual effect would be experienced by receptors in the foreground, middleground, and background distance. Visibility of the remaining deconstruction actions is expected to be limited to receptors within the middleground and foreground viewing distances due to the screening effect of surrounding topography and vegetation. Given the prominence of EJ populations in these viewing locations near the CUF Reservation, these effects would generally be experienced by EJ populations more than other populations and, therefore, be amplified on EJ populations.

3.18.2.3. Alternative A

3.18.2.3.1. Construction and Operation of CC Plant at CUF

Construction of a CC plant on the undeveloped portion (Site A2) of the CUF Reservation would result in direct visual effects. The new CC plant and accompanying equipment would be visually similar to other industrial elements present in the current landscape. Proposed final stack height for the HRSG will be 160 ft and the bypass stack will be 151 feet. The new stacks would likely be visible to rural residential receptors near the proposed CC plant site, and the steam produced would also likely be visible. With the exception of the stacks, visibility of the proposed CC plant construction is expected to be limited to receptors within the middleground viewing distance due to the screening effect of surrounding topography and vegetation. At the background distance, the proposed actions are not expected to be discernible due to the screening effects of terrain and overall distance, nor would they contrast with the overall landscape. The new CC plant would be mainly seen by employees and facility operators, as well as motorists on the adjacent Old Scott Road. Border trees and hedges may be planted as needed, and existing border vegetation would be maintained. Therefore, the site would generally be absorbed by surrounding industrial components and would become visually subordinate to the overall landscape character associated with the plant site. The use of downward and inward facing lighting will create a permanent visual effect within the project site.

During the construction of the CC plant, there would be slight visual discord from the existing conditions due to an increase in personnel and equipment in the area. There would also be an

increase in vehicular traffic along Cumberland City Road and Old Highway 149 due to employee traffic as well as barge and rail traffic during the hauling of material to and from the CUF, which would be noticeable to residents along those streets. Effects from additional vehicular traffic are expected to be minor as the roads within the plant are already predominately used by employees and for industrial activity. This small increase in visual discord would be temporary and intermittent and would only last until construction activities have been completed. Cumulative visual effects could occur with the proximity of the RFFAs, including planned CCR management activities. The visual effects for the revised potential impact boundaries are the same as noted above for the proposed CC plant site.

3.18.2.3.2. Construction and Operation of Natural Gas Pipeline

While most of the pipeline corridor is adjacent to the cleared 100-foot wide right-of-way of an existing TVA TL, construction of the pipeline and associated equipment would require clearing approximately 693 acres of forest from multiple areas. During pipeline construction, "temporary visual impacts will occur as a result of construction equipment and disturbed soil and vegetation" (TGP 2022h). During construction, there would be temporary, slight visual discord from the existing conditions due to an increase in personnel and equipment in the area. "Visual impacts during construction will be evident but will be short-term. The use of overhead cranes and other tall equipment would be necessary to place certain equipment, but use of these machines would be limited to a 10-month period" (TGP 2022h). There would also be an increase in vehicular traffic during the hauling of material to the corridor, which would be noticeable to residents near and along those roadways. Because materials would likely be transported on smaller roads in more rural areas along the corridor, this may create a more noticeable visual effect for nearby receptors rather than the effect of transporting materials via highway.

At the completion of pipeline construction, the pipeline corridor would be reseeded and, unless farmed, maintained as a mix of grasses, herbaceous vegetation, and shrubs, primarily by periodic mowing. In previously cleared areas, the visual impacts following site restoration and revegetation would be negligible. In previously forested areas, there would be a permanent visual impact. Along much of the pipeline corridor, the impact of the wider cleared corridor would be minor. The impact could be greater in locations where the cleared forest provided a visual screen at nearby residences. As stated in TGP's Resource Report 8 (TGP 2022h):

> The construction of the MLV will result in some visual impacts to nearby residences and passing traffic on Little Bartons Creek Road; however, because of its location adjacent to the TVA [TL], visual impacts are anticipated to be low in comparison to that of existing infrastructure in the area. The pressure regulation station site is composed of forest, open pastureland, and existing maintained pipeline ROWs. Although the site is within 40 feet of a residence and close to multiple other residences, the immediate area surrounding the site is composed of mature forest that would provide existing screening of the facility. TGP would install a 6-foot-high wooden fence along the facility boundary as a visual and noise screen. The only available views of the facility will be from passerby traffic along Pack Road. The Cumberland meter station would be constructed at the CC plant site on the CUF reservation and be largely out of sight from nearby residences and public roads.
>
> Planned and existing development projects considered in the cumulative impact analysis for land use and aesthetics are the TVA Cumberland Fossil Plant Retirement (TVA 2022c) and associated management of coal combustion residuals project, borrow areas and access road project, and wastewater treatment

facility project. The TVA Cumberland Fossil Plant Retirement and associated projects are in the vicinity of the northern terminus of the Project in Stewart County.

Project construction is not expected to result in significant incremental contributions to cumulative impacts on aesthetic resources. Project operation, when considered with other cumulative actions, could incrementally add to impacts on land use and aesthetics. However, the majority of the pipeline will be co-located with an existing utility corridor to the extent practicable, which would limit the cumulative effect to existing land uses or aesthetic values. The Cumberland meter station would be located at the northern terminus of the pipeline, in the vicinity of existing and planned industrial land uses, and could contribute to a cumulative impact to land use and aesthetics. The pressure regulation station would be located at the southern terminus of the pipeline, approximately 30 miles from the TVA Cumberland Fossil Plant Retirement and associated projects; therefore, the pressure regulation station will result in land use and aesthetics impacts but will not contribute to visual cumulative impacts.

3.18.2.3.3. Transmission and Other Components

The proposed transmission lines associated with Alternative A would be contained within the CUF Reservation and have the same effects to visual resources as described in Section 3.18.1.1.

3.18.2.3.4. Summary of Alternative A

In sum, permanent visual effects would occur as a result of the construction of the CC plant and accompanying equipment, aboveground natural gas structures, and areas along TL and pipeline corridors where forestland is converted to maintained open space. Where applicable, fencing and vegetative screening would be used to mitigate visual effects. Overall, the construction of Alternative A would largely blend in with the existing industrial environment and will not create significant visual discord.

3.18.2.3.5. Environmental Justice Considerations

Alternative A-related activities would increase the visual effects on local populations, both EJ and non-EJ. Given the prominence of EJ populations at the CC plant location and in the pipeline corridor, these effects would generally be experienced by EJ populations more than other populations. Further, some of the most visually intrusive activities and components, including the HDD locations and the Cumberland Meter Station, are located in EJ areas; therefore, these effects have the potential to be amplified on EJ populations.

3.18.2.4. Alternative B

3.18.2.4.1. Construction and Operation of CT Plant at Johnsonville Reservation

During the construction of the CT plant, there would be slight visual discord from the existing conditions due to an increase in personnel and equipment in the area. There would also be an increase in rail and vehicular traffic along the existing rail spur, Industrial Park Road, and U.S. 70 during the hauling of material to and from the site, which would be noticeable to residents along those streets.

Construction of CT plant would result in short-term visual effects associated with construction activities in all project areas impacted by the proposed onsite and offsite actions. During the approximately two-year construction period, there would be increased visual discord from existing conditions due to an increase in personnel and equipment coupled with disturbances of laydown and staging areas. However, this would be contained within the immediate vicinity of

the construction activities, which is a developed, industrial portion of the reservation, and would only last until all project activities have been completed and the disturbed areas have been seeded and restored through the use of TVA's standard BMPs. Because of their temporary nature, construction-related effects to local visual resources are expected to be minor.

Long-term effects resulting from the construction of the CT plant would include visible alterations to the existing landscape associated with the plant, including stacks up to 199 feet tall with a possible visible plume and transmission structures. These elements would be visually similar to other industrial structures seen in the current landscape of the Johnsonville Reservation. These elements contribute to the landscape's ability to absorb negative visual change and would minimize the visual effect of the proposed action. Furthermore, the proposed CT plant facilities would have minimal public visibility, with unobstructed views generally limited to employees and visitors to the Johnsonville Reservation and boaters on the nearby Kentucky Reservoir. Plant lighting would create a permanent visual effect within the project site, but the USFWS-recommended downward and inward facing lighting to limit attracting wildlife would minimize light pollution for the surrounding area.

Cumulative visual effects could occur from RFFAs, including the adjacent Aeroderivative CT project, but would be minor because of the current landscape of the reservation.

3.18.2.4.2. Construction and Operation of CT Plant at Gleason Reservation

Visual effects related to the construction of the CT plant at the Gleason Reservation would be similar to those discussed at the Johnsonville reservation. Unlike Johnsonville, however, the Gleason CT plant site would be located on undeveloped land adjacent to an existing CT plant. Long-term effects resulting from the construction of the CT plant would include visible alterations to the existing landscape associated with the plant, including stack heights up to 199 feet tall with a visible plume, as well as the proposed transmission structures. These elements would be visually similar to the existing Gleason CT plant. These elements contribute to the landscape's ability to absorb negative visual change and would minimize the visual effect of the proposed action. The new structures may be visible to rural residences near the Gleason Reservation. Plant lighting would create a permanent visual effect within the project site, but the USFWS-recommended downward and inward facing lighting to limit attracting wildlife would minimize light pollution for the surrounding area.

The 60 acres that would be used as needed for vehicle and equipment parking, materials storage, laydown, and construction administration during construction of the proposed CTs are located on undisturbed areas. When construction is complete, they would be allowed to revert to their original use. Thus, visual effect because of laydown areas would be moderate but temporary.

During the construction of the CT plant, there would be slight visual discord from the existing conditions due to an increase in personnel and equipment in the area. There would also be an increase in vehicular traffic along Janes Mill Road and Highway 22 during the hauling of material to and from the site, which would be noticeable to residents along those streets. This small increase in visual discord would be temporary and intermittent and only last until construction activities have been completed.

The construction of the plant would contribute to a minor change in visual integrity of the landscape due to construction activities which affect the local viewshed. Scenic attractiveness may be reduced in the foreground during increased activity but would remain common in the

middleground and background. Border trees and hedges will be planted as needed, and existing border vegetation would be maintained.

Cumulative visual effects could occur from RFFAs, but would be minor because of the current landscape of the reservation.

3.18.2.4.3. Transmission and Other Components

The proposed 40-mile, 500-kV transmission line has the potential to result in moderate adverse visual effects, as this would be a new line across a largely agricultural landscape. It would also result in a prominent cleared corridor where the line crosses previously forested areas. The transmission line would be visible at foreground, middleground, or background distances, depending on the extent of vegetation and topography.

During the construction of the TLs and other electrical system components, there would be slight visual discord from the existing conditions due to an increase in personnel and equipment in the area. There would also be an increase in vehicular traffic along Highway 45, 22, and 54 due to employee traffic. Effects from additional vehicular traffic are expected to be minor as these roads are already predominately used by employees and for industrial activity. This small increase in visual discord would be temporary and intermittent and only last until construction activities have been completed.

Detailed analyses of visual resource effects would be conducted under supplemental NEPA reviews if Alternative B is selected as the preferred alternative.

3.18.2.4.4. Environmental Justice Considerations

Visual effects due to the CT facilities would be minor and generally limited to the immediate TVA-owned reservations or nearby vicinity. While there are no EJ populations in the immediate vicinity of the Gleason Reservation, EJ populations are present near JCT. Therefore, these short-term negative conditions could be amplified on EJ populations, given their proximity to JCT.

3.18.2.5. Alternative C

3.18.2.5.1. Construction and Operation of Solar and Storage Facilities

The construction of the proposed solar and storage facilities would result in localized visual effects as they would introduce industrial elements onto sites that are typically relatively flat and largely cropland, pasture, and/or hayfields. Visual effects could occur over the approximately 21,900 acres for the solar facilities and 640 acres for the battery storage facilities. Visual effects for solar would be spread across multiple solar and storage sites. The solar and storage facility components are typically low profile and less than 15 feet tall except for taller substation components and transmission structures supporting electrical lines that connect the facilities to existing nearby transmission lines. The solar facility sites are typically replanted with grasses and other low vegetation following construction, and low-profile vegetation is maintained during operation by periodic mowing or grazing. The solar and storage facility sites are enclosed by security fencing and any night-lighting is typically motion-activated. Where visual effects are identified as a concern during facility design, or as required by ordinances in some communities, the facilities may be screened by planted trees and shrubs, constructed berms, or both. Detailed analyses of visual effects would occur for each solar or BESS site under future NEPA reviews.

Cumulative visual effects would occur if Alternative C was combined with the 10,000 MW expansion of solar planned in the 2019 TVA IRP, which would create long-term, cumulative

increases in viewshed changes in the region. Cumulative effects would be minimized through proper siting, setbacks, visual screening and buffers, and lighting.

3.19. Unavoidable Adverse Environmental Effects

Unavoidable adverse effects are the effects of the proposed action on natural and human resources that would remain after mitigation measures or BMPs have been applied. Effects associated with the retirement and deconstruction of the CUF coal plant, the construction and operation of the proposed CUF CC plant and natural gas pipeline (Alternative A), the CT plants at JCT and Gleason (Alternative B), or solar and storage facilities (Alternative C) and associated TL lines and upgrades have the potential to cause unavoidable adverse effects to several natural and human environmental resources. TVA has reduced the potential for adverse effects through appropriate planning in designing replacement generation facilities. In addition, TVA would implement mitigation measures (Section 2.3) to further reduce potential adverse effects to certain environmental resources.

3.19.1. Land Use Effects

All the replacement generation alternatives would result in the permanent conversion of undeveloped land into an industrial use, with the exception of the proposed CT plant at JCT (Alternative B), which has been previously developed. The new pipeline built by TGP and TVA's TL would also convert undeveloped land, including forest, into cleared, maintained corridors.

3.19.2. Surface Water and Wetland Resources Effects

Under all the replacement generation alternatives, the construction of the replacement generation would also result in minor effects to surface water and wetland resources. These effects would be mitigated through adherence to permit requirements and the provision of appropriate compensatory mitigative measures, if needed. The proposed natural gas pipeline (Alternative A) would likely avoid some of these features by boring or directionally drilling beneath them, and would not result in permanent impacts. New TLs (Alternatives A, B, and C) would likely span wetlands and waters to the extent practicable. Temporary effects to water quality from runoff during construction, as well as ongoing vegetation maintenance along the pipeline and TLs, could affect nearby receiving water bodies but would be reduced with application of appropriate BMPs.

3.19.3. Air and Noise Emissions Effects

Under all the replacement generation alternatives, unavoidable localized increases in air and noise emissions would also occur during construction activities. Activities associated with the use of construction equipment may result in varying amounts of dust, air emissions, and noise that may potentially affect onsite workers, users of adjacent recreational lands and water bodies, and residents located near the offsite TL segments and natural gas pipeline lateral. Potential noise effects also include traffic noise associated with the construction workforce traveling to and from the site. Emissions from construction activities and equipment would be minimized through implementation of BMPs including proper maintenance of construction equipment and vehicles. With proper project siting, avoidance, minimization and mitigation measures, low income and minority communities would not suffer any amplified air, dust, noise, transportation, or waste effects.

3.19.4. Other Resource Effects

Under all the replacement generation alternatives, temporary increases in traffic would be minimized or mitigated by specific measures designed to address traffic flow issues, if necessary. Temporary increases in health and safety risks would be minimized by implementation of the project health and safety plan. Construction and operation would have

minor, localized effects on soil erosion and sedimentation that would be minimized by establishment and maintenance of stream and wetland buffers, soil stabilization, and vegetation management measures.

Construction of the proposed solar facilities would likely be the subject of CWA Section 404/401 permitting and ESA Section 7 consultation, and long-term effects would be mitigated through application of CWA permit conditions and ESA mitigation measures. Alternative C would result in the conversion of about 21,900 acres of largely agricultural land to industrial use, although livestock grazing is likely occurring now on at least some of the solar facility sites. Revegetation of solar sites with native or non-invasive grasses and herbaceous vegetation would help minimize effects to open, grassy habitats.

Habitat alterations associated with Alternative C would result in effects to localized plant communities and wildlife habitat on the affected lands. However, due to the abundant habitat of similar quality within the vicinity of the project sites, the overall effect to vegetation and wildlife is considered minor. Effects to federally listed endangered and threatened species would be mitigated in consultation with the USFWS. When actions taken are those that are addressed in TVA's Programmatic Consultation with USFWS addressing routine actions and federally listed bats, project-specific Conservation Measures would be implemented to minimize effects to federally listed bats. TVA and developers under power purchase agreements would also employ avoidance measures to avoid significant effects to any state-listed plants and any previously undocumented populations of federally or state-listed species identified during future surveys for Alternative C.

3.19.5. Agency Consultations

Section 106 consultation with TN SHPO and tribes is complete for the TVA construction-related components of the proposed CC plant and transmission work under Alternative A. While the retirement and deconstruction of the CUF plant would not result in adverse effects to cultural resources, the proposed replacement generation TL infrastructure will result in adverse effects to the historic Henry Hollister House. TVA coordinated with the TN SHPO on development of a MOA identifying measures to mitigate impacts to the Hollister House. The MOA between TVA and the SHPO was finalized on September 22, 2022. Specific mitigation requirements of the MOA are described in Section 2.3, Section 3.13, and Appendix M.

TVA requested concurrence from USFWS under Section 7 of the ESA for the "may affect not likely to adversely affect" determinations for CUF retirement, CC Plant Construction, and transmission upgrades in a letter dated May 4, 2022. TVA determined that proposed actions would not affect bald eagle, pink mucket, rabbitsfoot, tan riffleshell, yellow-blossom pearlymussel, Cumberland combshell, orangefoot pimpleback, pink mucket, and ring pink, and Nashville crayfish. TVA determined that proposed actions may affect but are not likely to adversely affect Braun's rockcress, leafy prairie-clover, Price's potato-bean, Pyne's ground plum, Short's bladderpod, and gray bat. TVA also notified the USFWS of use of "Take" from the Biological Opinion for TVA's programmatic consultation with the USFWS on routine actions that may affect endangered or threatened bats. Finally, TVA determined proposed actions would not jeopardize the continued existence of alligator snapping turtle, and monarch butterfly. On July 20, 2022, a letter of concurrence was received by the USFWS in response to TVA's Section 7 consultation. On August 26 2022, USFWS concurred with design changes and minor additions to tree removal estimates, indicating that approximately 42.89 acres of "take" for suitable bat habitat tree removal during the winter season will be used from TVA's programmatic consultation with USFWS in association with this project. The USFWS letter of concurrence is included in Appendix K along with the Bat Strategy Project Screening form that identifies

conservation measures that apply to this project. Additional USFWS consultation documentation are provided in Appendix L.

3.19.6. Conclusions

In the context of the availability of regional resources that are similar to those unavoidably adversely affected by all the replacement generation alternatives, coupled with the application of appropriate BMPs and adherence to permit requirements, unavoidable adverse effects are anticipated to be minor.

3.20. Relationship of Short-Term Uses and Long-Term Productivity

NEPA requires a discussion of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. This EIS focuses on the analyses of environmental effects associated with the retirement, decommissioning and deconstruction of the existing CUF plant, and replacement of power generated through construction of a CC plant on the CUF site (Alternative A), construction of CT plants at JCT and Gleason Reservations (Alternative B), or construction of solar and BESS facilities (Alternative C), as well as associated offsite natural gas pipeline laterals, TLs, and TL upgrades. These activities are considered short-term uses of the environment for the purposes of this section. In contrast, the long-term productivity is considered to be that which occurs beyond the conclusion of decommissioning the plants and associated infrastructure. This section includes an evaluation of the extent that the short-term uses preclude any options for future long-term use of the project sites.

All buildings and structures within the proposed CUF plant demolition boundary would be decontaminated and demolished to grade or to the top of the mooring cells. In the long-term, the site could become productive if commercial or industrial facilities were to be established, thereby producing employment opportunities and tax revenue and enhancing long-term productivity of the site.

Construction of the replacement generation plants, associated pipelines, and TL upgrades would cause a minor, short-term deterioration in existing air quality during construction. These effects would be mitigated through implementation of mitigative measures to reduce emissions from construction phase equipment and minimize emissions of fugitive dust. All of the action alternatives would result in a long-term beneficial effect on air quality and GHG emissions. Therefore, there would be no effect on the enhancement of long-term productivity related to air quality or climate change following decommissioning of the CUF plant.

Construction of the proposed CC plant, including the natural gas pipeline lateral (Alternative A), or CT plants and TL infrastructure (Alternative B), would reduce the long-term productivity of the land for other purposes while these facilities are in operation. The proposed generation facilities are located on existing TVA reservations, and in the case of the JCT CT plant, would be located in an area developed for heavy industrial use. Because the vicinity of the project area includes similar vegetation and habitat types, the short-term disturbance to support plant operations is not expected to significantly alter long-term productivity of wildlife, agriculture, or other natural resources. After decommissioning, the lands could be reused and made available for other uses.

Constructing solar facilities (Alternative C) would affect short-term uses of the project sites by converting them from agricultural and forested land to solar power generation. The effects on long-term productivity would be minimal, as existing land uses could be readily restored on the sites following the decommissioning and removal of the solar facilities.

3.21. Irreversible and Irretrievable Commitments of Resources

The term “irreversible commitments of resources” describes environmental resources that are potentially changed by the construction or operation of the proposed projects that could not be restored to their prior state by practical means at some later time. Irreversible commitments generally occur to nonrenewable resources such as minerals or cultural resources and to those resources that are renewable only over long timespans, such as soil productivity. A resource commitment is considered irretrievable when the use or consumption is neither renewable nor recoverable for use until reclamation is successfully applied. Irretrievable commitments generally apply to the loss of production, harvest, or other natural resources and are not necessarily irreversible.

Resources required by decontamination and deconstruction activities, including labor and fossil fuels, would be irretrievably lost. Nonrenewable fossil fuels would be irretrievably lost through the use of gasoline and diesel-powered equipment during construction. However, it is highly unlikely that their limited use in these projects would adversely affect the overall future availability of these resources.

The land used for the proposed CC (Alternative A), CT (Alternative B), or solar/storage (Alternative C) plants and associated infrastructure is not irreversibly committed because once the plants cease operations and the facilities are decommissioned, the land supporting the facilities could be returned to other industrial or nonindustrial uses. The ROW used for the natural gas pipeline lateral and TLs would constitute an irreversible commitment of onsite resources, for the length of time the pipeline and TLs are in place. However, the approximate previous land use and land cover could be returned upon retirement of these facilities. In the interim, compatible uses of the ROW could continue.

Operation of the CC or CT plants would result in the irretrievable loss of natural gas, which would be used to fuel the CCs or CTs. In addition, the materials used for the construction of the proposed site would be committed for the life of the facilities. However, these fossil fuels and building materials are not in short supply at this time and their use would not have an adverse effect upon continued availability of these resources.

The implementation of Alternative C would involve irreversible commitment of fuel and resource labor required for the construction, maintenance, and operation of the solar and BESS facilities. Because removal of the solar arrays and associated on-site infrastructure could be accomplished rather easily, and the facilities would not irreversibly alter the site, the project sites could be returned to their original condition or used for other productive purposes once the solar facility is decommissioned. Rare earth metals and minerals are used in solar modules and lithium-ion batteries; solar and battery facility components could be recycled after the facility is decommissioned.

CHAPTER 4 - SUBMITTED ALTERNATIVES, INFORMATION AND ANALYSES

4.1. Submitted Alternatives, Information and Analyses

4.1.1. Scoping Period

The EIS includes a summary that identifies all alternatives, information and analyses submitted by State, Tribal, and local governments, in Section 1.4, and other public commenters during the scoping process for consideration in developing the EIS (40 CFR 1502.17). During the scoping period, the Southern Environmental Law Center recommended that in addition to proposed Alternative C, the EIS should include a blend of these alternatives:

- Distributed solar;
- Onshore wind;
- Demand response and energy efficiency;
- Solar (distributed and utility-scale), onshore wind, energy efficiency, demand response, and battery storage; and
- Purchased carbon-free power.

TVA's 2019 IRP evaluated the recommendations in this proposed alternative, including distributed solar, onshore wind, and demand response and energy efficiency. The target power supply mix adopted from the IRP optimizes each of these resource generation types. The Alternatives selected for consideration in this EIS are one aspect of the overall asset strategy that resulted from the IRP. Alternative C evaluates the potential for 3,000 MW of utility-scale solar and 1,700 acres of energy storage facilities. This 3,000 MW would be in addition to the approximately 10,000 MW of solar additions by 2035 that is currently included in TVA's long-term plans. Section 2.1 provides additional information related to the proposed alternatives.

4.1.2. Public Comments on Draft EIS

Additionally, the three studies listed below were submitted to TVA during the public comment period on the draft of this EIS:

- Synapse Energy Economic Inc. report "Clean Portfolio Replacement at Tennessee Valley Authority: Economic and Emissions Benefits for TVA Customers" (Synapse 2022). Submitted by Southern Environmental Law Center (SELC).
- From EPA: "The Synapse report transparently lays out important modeling approaches and cost, emissions and other input data. They also explore hybrid options that offer lower costs and better environmental results. Ideally, the FEIS (FEIS) will be equally transparent so readers can compare input assumption and modeling results, including results about costs and environmental impacts."
- Michael Goggin, Grid Strategies, LLC, Critique of TVA's Alternatives Analysis in the Utility's "Cumberland Fossil Plant Retirement, Draft Environmental Impact Statement" (June 13, 2022) (Goggin 2022). Submitted by SELC.
- The Howard H. Baker Jr. Center for Public Policy, "Ensuring Natural Gas Capacity to Meet Tennessee's Economic Development Needs". Prepared for the Tennessee State

Energy Policy Council by Matthew N. Murray, PhD | Senior Fellow (Howard H. Baker Jr. Center for Public Policy 2022).

TVA contracted Concentric Energy Advisors (Concentric) to assess the submitted Synapse Energy and Grid Strategies reports. The Concentric analysis and conclusions are provided in Appendix Q. The Concentric report concludes:

- The TVA board-approved 2019 IRP serves as a solid basis and analytic framework for future TVA resource decisions
- The Cumberland retirement project represents an early step of a broader strategic plan
- Long-term resource plans that do not include natural gas generation rely on overly optimistic assumptions
- The use of near-term combined cycle generation deployments establishes a solid foundation for aggressive renewable energy deployment.

As such, Concentric concluded that selection by TVA of its preferred alternative, Alternative A, would represent a practical and reasonable alternative and near-term implementation plan.

TVA reviewed the report by the Howard H. Baker Jr. Center for Public Policy and responses to the report are included in the responses to comments received on the DEIS, provided in Appendix O.

After the 45-day public comment period on the DEIS, TVA also received 2 late comments regarding the Biden Administration's Inflation Reduction Act (IRA) of 2022, which was enacted after conclusion of the DEIS public comment period. Although these comments were received after the public comment period had closed, TVA addressed the IRA as it relates to this project in Chapter 1 of the Final EIS and the Response to Comments document in Appendix O.

CHAPTER 5 – LIST OF PREPARERS

5.1. NEPA Project Management

Ashley Pilakowski
Education: B.S., Environmental Management
Project Role: TVA NEPA Project Manager
Experience: 12 years in environmental planning and policy and NEPA compliance

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Education: B.S., Environmental Science
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Charles P. Nicholson, PhD (HDR)
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Project Role: QAQC and Technical Advisor
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Misty Huddleston, PhD (HDR)
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Education: M.E.M., Environmental Management; B.S., Integrated Sciences and Technology (Environmental Science and GIS)
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5.2. Other Contributors

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Education: M.S., Wildlife and Fisheries Science and B.A. Biology
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Education: M.B.A.; B.S.B.A., Finance and Management of Information Systems
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Experience: 29 hydrogeology and contaminated site assessment & remediation

Gracelyn Jones (HDR)
Education: B.A. Environmental Sociology
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Experience: 21 years in anthropology, archaeology, history, and NHPA and NEPA documentation

Al Myers (HDR)
Education: Completed credits toward B.S., Business Administration
Project Role: Technical Editing
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Carrie Williamson, P.E., CFM (TVA)
Education: B.S. and M.S. Civil Engineering
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Experience: 9 years in Floodplains and Flood Risk; 3 years in River Forecasting; 11 years in Compliance Monitoring

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Education:	M.E.M., Environmental Management; B.S., Environmental Studies
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Experience:	6 years in resource planning and power market forecasting

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CHAPTER 6 – LITERATURE CITED

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Appendix A – TVA IRP Executive Summary

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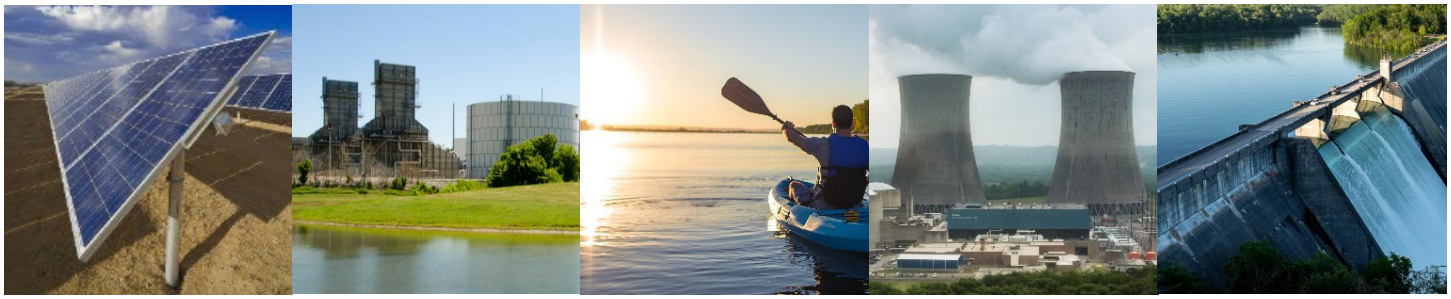
2019 Integrated Resource Plan

EXECUTIVE SUMMARY



TENNESSEE VALLEY AUTHORITY

Introduction

PURPOSE AND NEED

The Tennessee Valley Authority's 2019 Integrated Resource Plan (IRP) is a long-term plan that provides direction on how TVA can best meet future demand for power. It shapes how TVA will provide low-cost, reliable and clean electricity; support environmental stewardship; and foster economic development in the Tennessee Valley for the next 20 years. The plan is a crucial element for TVA's success in a constantly changing business and regulatory environment, and it will better equip TVA to meet many of the challenges facing the electric utility industry in the coming years to benefit the Valley. The IRP will enhance TVA's ability to create a more flexible power-generation system that can successfully integrate increasing amounts of renewable energy sources and distributed energy resources (DER) while ensuring reliability. The IRP also will inform TVA's next Long-Range Financial Plan.

TVA POWER SYSTEM

As the nation's largest public power provider, TVA delivers safe, reliable, clean, competitively priced electricity to 154 local power companies and 58 directly served customers. TVA's power portfolio is dynamic and adaptable in the face of changing demands and regulations. TVA's portfolio has evolved over the past decade to a more diverse, reliable and cleaner mix of generation resources, which today provides 54 percent carbon-free power. In Fiscal Year (FY) 2018, TVA efficiently delivered more than 163 billion kilowatt-hours of electricity to customers from a power supply that was 39 percent nuclear, 26 percent natural gas, 21 percent coal-fired, 10 percent hydro, and 3 percent wind and solar. The remaining one percent results from TVA programmatic energy efficiency efforts.

SUMMARY OF IRP PROCESS AND GOALS

TVA used an integrated, least-cost framework that considered multiple views of the future to determine how potential power-generation resource portfolios could perform in different market and external conditions. We conducted the IRP process in a transparent, inclusive manner that provided numerous opportunities for public education and participation. Stakeholders and the public provided invaluable input that helped shape the IRP. The analysis performed in this IRP study relied on industry-standard models and incorporated best practices while using an innovative methodology to more fully evaluate the role of distributed energy resources as resources in our power supply. Resource cost and performance input data were independently validated. TVA's goal with the IRP was to identify an optimal energy resource plan that performs well under a variety of future conditions, taking into account cost, risk, environmental stewardship, operational flexibility and Valley economics. Per the National Environmental Policy Act (NEPA), TVA also prepared an Environmental Impact Statement (EIS) to analyze the 2019 IRP's potential impacts on the environment, economy and population in the Tennessee Valley.

TVA's 2019 IRP Recommendation

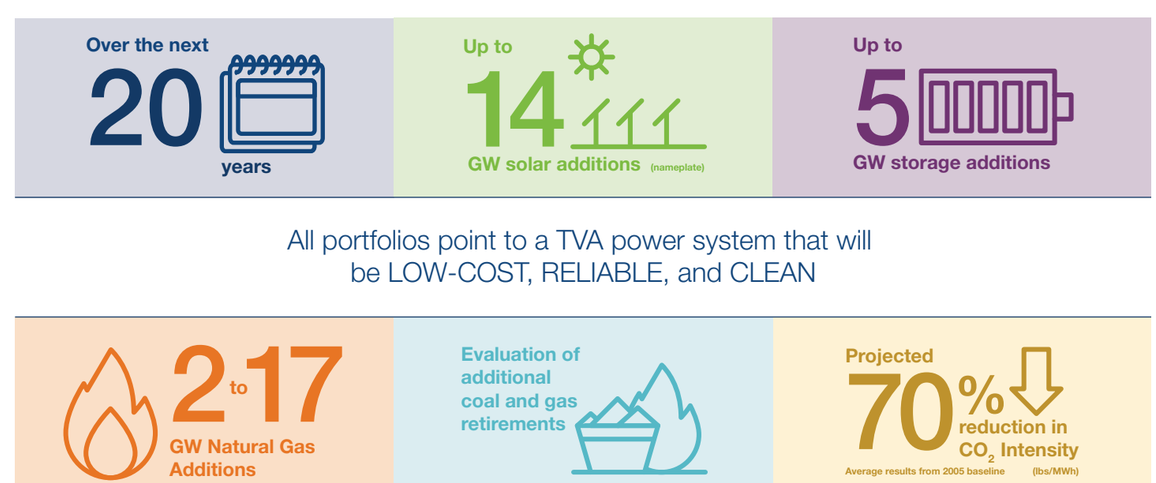
STUDY RESULTS

During the IRP process, TVA — with significant input from stakeholders and the public — considered a wide range of future scenarios, various business strategies and a diverse mix of power-generation resources to build on TVA's existing asset portfolio. IRP study results show:

- There is a need for new capacity in all scenarios to replace expiring or retiring capacity.
- Solar expansion plays a substantial role in all futures.
- Gas, storage and demand response additions provide reliability and/or flexibility.
- No baseload resources (designed to operate around the clock) are added, highlighting the need for operational flexibility in the resource portfolio.
- Additional coal retirements occur in certain futures.
- Energy efficiency (EE) levels depend on market depth and cost-competitiveness.
- Wind could play a role if it becomes cost-competitive.
- In all cases, TVA will continue to provide for economic growth in the Tennessee Valley.

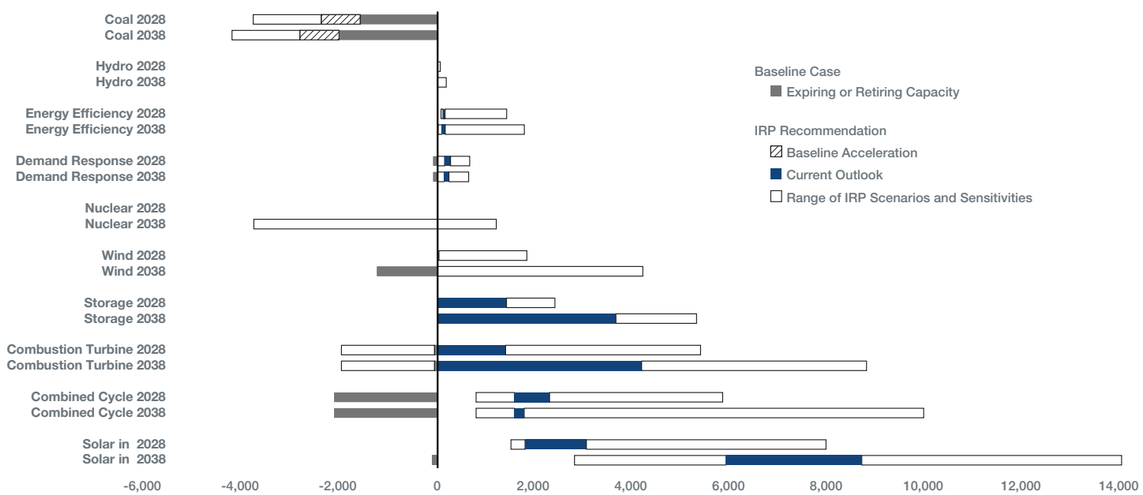
OBSERVATIONS

TVA has observed that the scenario, or future environment, it finds itself operating in will have more impact on overall results than the strategy or strategies it implements. TVA also recognizes that all strategies have positive aspects but also have unique tradeoffs to consider. If TVA needs to shift its resource mix, that need will be driven by these key variables: changing market conditions, more stringent regulations and technology advancements. Recognizing that a variety of future scenarios are possible and each strategy has positive aspects, all IRP results are included in the IRP Recommendation to provide flexibility for how the future evolves.



TVA's 2019 IRP Recommendation

Range of MW Additions and Subtractions by 2028 and 2038



Notes

- **MWs are incremental additions from 2019 forward. Board-approved coal retirements are excluded from the totals.**
- **Browns Ferry Nuclear Plant license is not extended in the No Nuclear Extensions Scenario (outside of TVA control).**
- **Upper bounds of potential natural gas and solar additions are driven by the Valley Load Growth Scenario.**
- **Solar and wind are shown in nameplate capacity; accelerated solar additions are reflected in the IRP Recommendation.**
- **Solar, gas, and storage ranges include utility-scale and distributed additions (where promoted in a strategy).**

TVA's 2019 IRP Recommendation

TVA's recommended planning direction affirms its commitment to a diverse and flexible resource portfolio guided by the least-cost system planning mandate. The ranges shown, stated in megawatts (MW) of capacity, provide a general guideline for resource selections. In developing a Recommendation from the study, TVA elected to establish guideline ranges for key resource types (owned or contracted) that make up the target power supply mix. This general planning direction is expressed over the 20-year study period while also including more specific direction over the first 10-year period. Meeting the Valley's future needs in accordance with the resource technologies and ranges in this Recommendation will position TVA to continue to deliver low-cost, reliable and clean power to the people of the Tennessee Valley.

Coal: Continue with announced plans to retire Paradise in 2020 and Bull Run in 2023. Evaluate retirements of up to 2,200 MW of additional coal capacity if cost-effective.

Hydro: All portfolios reflect continued investment in the hydro fleet to maintain capacity. Consider additional hydro capacity where feasible.

Energy Efficiency: Achieve savings of up to 1,800 MW by 2028 and up to 2,200 MW by 2038. Work with our local power company partners to expand programs for low-income residents and refine program designs and delivery mechanisms with the goal of lowering total cost.

Demand Response: Add up to 500 MW of demand response by 2038 depending on availability and cost of the resource.

Nuclear: Pursue option for second license renewal of Browns Ferry for an additional 20 years. Continue to evaluate emerging nuclear technologies, including small modular reactors, (SMR) as part of technology innovation efforts.

Wind: Existing wind contracts expire in the early 2030s. Consider the addition of up to 1,800 MW of wind by 2028 and up to 4,200 MW by 2038 if cost-effective.

Storage: Add up to 2,400 MW of storage by 2028 and up to 5,300 MW by 2038. Additions may be a combination of utility and distributed scale. The trajectory and timing of additions will be highly dependent on the evolution of storage technologies.

Gas Combustion Turbine: Evaluate retirements of up to 2,000 MW of existing combustion turbines if cost-effective. Add up to 5,200 MW of combustion turbines by 2028 and up to 8,600 MW by 2038 if a high level of load growth materializes. Future CT needs are driven by demand for electricity, solar penetration, and evolution of other peaking technologies.

Gas Combined Cycle: Add between 800 and 5,700 MW of combined cycle by 2028 and up to 9,800 MW by 2038 if a high level of load growth materializes. Future CC needs are driven by demand for electricity and gas prices, as well as by solar penetration that tends to drive CT instead of CC additions.

Solar: Add between 1,500 and 8,000 MW of solar by 2028 and up to 14,000 MW by 2038 if a high level of load growth materializes. Additions may be a combination of utility and distributed scale. Future solar needs are driven by pricing, customer demand, and demand for electricity.

The IRP Recommendation meets the dual objective of ensuring flexibility to respond to the future while providing guidance on how our resource portfolio should change as the future unfolds.

Implementation

CONSIDERATIONS

With the implementation of the IRP Recommendation will come certain challenges. For example, the IRP Recommendation includes significant renewables expansion, which means it will become increasingly important to know the location of renewable resources, both utility and distributed scale, and how weather impacts solar generation. Early experience with battery storage on the system would provide additional insight to how the various storage-use cases might be employed to provide economic benefit and system flexibility, especially with increasing penetration of renewables. TVA will need to partner with local power companies and other stakeholders in the region to better understand the potential for distributed resources in the Valley and their locational value to inform resource decisions. Finally, the IRP Recommendation also includes more conventional resources, primarily gas-fired, and TVA will need to consider the implementation challenges in the areas of siting and permitting, both for the units themselves and associated transmission lines and gas pipelines.

In the process of developing the IRP, stakeholders raised a number of policy-related issues that are outside the scope of the IRP itself but will need to be considered as TVA moves toward implementation of recommendations from the IRP study. These considerations include continued evolution of programs that provide flexibility for customer-owned generation, evolution of federal/state energy and environmental policies, advancements in customer expectations and requirements for clean energy, and enhancing low-income equity and energy/environmental justice.

NEAR-TERM ACTIONS

The scenarios and strategies evaluated in the IRP provide insights to how TVA's resource portfolio may need to evolve as the future becomes clearer. The results indicate there are near-term actions that would provide benefit across multiple futures. The actions include:

RENEWABLES & FLEXIBILITY

- Add solar based on economics and to meet customer demand.
- Enhance system flexibility to integrate renewables and distributed resources.
- Evaluate demonstration battery storage to gain operational experience.

EXISTING FLEET

- Pursue option for license renewal for TVA's nuclear fleet.
- Evaluate engineering end-of-life dates for aging fossil units to inform long-term planning.

ENERGY USAGE

- Conduct market potential study for energy efficiency and demand response.
- Collaborate with states and local communities to address low-income energy efficiency.
- Collaboratively deploy initiatives to stimulate the local electric vehicle market.

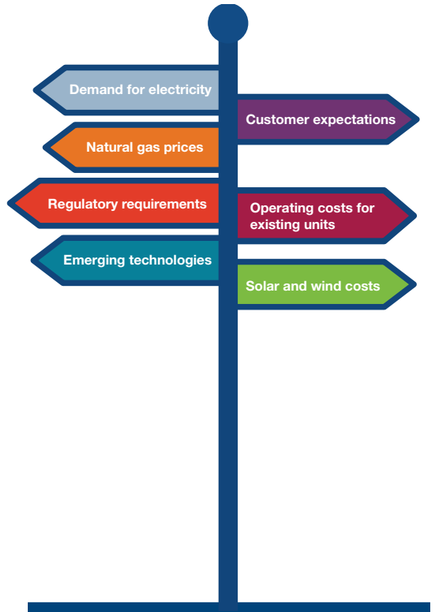
DISTRIBUTION PLANNING

- Support development of Distribution Resource Planning for integration into TVA's planning process.

2019 Integrated Resource Plan (IRP)
Executive Summary

KEY SIGNPOSTS TO GUIDE DECISIONS IN THE LONGER TERM

As the future unfolds, TVA will monitor key signposts that will guide decisions in the longer term. The signposts relate to key variables that could have a significant influence on the future generation portfolio. These key signposts include:



TVA will closely monitor these key drivers related to changing market conditions, more stringent regulations, and technology advancements to inform appropriate actions within the recommended ranges and appropriate timing for initiating the next IRP.

How TVA Developed the Integrated Resource Plan: An 18-Month Process

OVERVIEW

Developing the 2019 IRP has been an approximately 18-month process that began in February 2018 and will conclude when a Record of Decision is released. The IRP process will have included the following activities:

- **Scoping,** which took place in winter/spring 2018 and identified issues important to the public and laid the foundation for developing the IRP.
- **Development of Model Input and Framework,** which occurred in spring/summer 2018 and included identifying and developing scenarios, resource options and business strategies to evaluate how a future portfolio might change under different conditions.
- **Analysis and Evaluation,** which took place in fall 2018 and included developing and evaluating the performance of the 30 resource portfolios.
- **Presentation of Initial Results,** which occurred in February 2019 with release of the draft IRP and EIS.
- **Public Comment Period,** which was held from February 15 to April 8, 2019.
- **Additional Analysis,** which was completed in response to stakeholder and public comments.
- **Completion of the Study**, which includes the IRP Recommendation, near-term actions and key signposts, and the final environmental assessment.
- **Publication of the Final IRP and EIS** on June 28, 2019, on TVA's website.
- **Expected Request for Approval** of the IRP Recommendation from the Board in August 2019.
- **Record of Decision** will be published after Board approval.

Developing the IRP

PLANNING APPROACH

Uncertainties and Scenarios
With input from the IRP Working Group, TVA designed scenarios that are outside of TVA's control but represent possible futures in which TVA may find itself operating. TVA created a list of uncertainties that could alter the future operating environment and affect the cost of electricity and/or mix of optimal resources. The scenarios are:

	SCENARIOS
1	**CURRENT OUTLOOK** which represents TVAs current forecast for these key uncertainties and reflects modest economic growth offset by increasing efficiencies;
2	**ECONOMIC DOWNTURN** which represents a prolonged stagnation in the economy, resulting in declining loads (customers using less power) and delayed expansion of new generation;
3	**VALLEY LOAD GROWTH** which represents economic growth driven by migration into the Valley and a technology-driven boost to productivity, underscored by increased electrification of industry and transportation;
4	**DECARBONIZATION** which is driven by a strong push to curb greenhouse gas emissions due to concern over climate change, resulting in high CO_2 emission penalties and incentives for non-emitting technologies;
5	**RAPID DER ADOPTION** which is driven by growing consumer awareness and preference for energy choice, coupled with rapid advances in technologies, resulting in high penetration of distributed generation, storage and energy management;
6	**NO NUCLEAR EXTENSIONS** which is driven by a regulatory challenge to relicense existing nuclear plants and construct new, large-scale nuclear. This scenario also assumes subsidies to drive small modular reactor (SMR) technology advancements and improved economics.

Strategies
With input from the IRP Working Group, TVA developed five strategies, which are business decisions or directions that TVA could employ in each scenario. As it relates to strategies in the IRP, the word "promote" means an incentive was modeled to make the resource more attractive for adoption or selection. The five strategies are:

	STRATEGIES
A	**BASE CASE** which represents TVAs current assumptions for resource costs and applies a planning reserve margin constraint. This constraint applies in every strategy and represents the minimum amount of capacity required to ensure reliable power;
B	**PROMOTE DISTRIBUTED ENERGY RESOURCES** which incents DER to achieve higher, long-term penetration levels. The DER options include energy efficiency, demand response, combined heat and power, distributed solar and storage;
C	**PROMOTE RESILIENCY** which incents small, agile capacity to maximize operational flexibility and the ability to respond to short-term disruptions on the power system;
D	**PROMOTE EFFICIENT LOAD SHAPE** which incents targeted electrification (by incentivizing customers to increase electricity usage in off-peak hours) and demand response (by incentivizing customers to reduce electricity usage during peak hours). This strategy promotes efficient energy usage for all customers, including those with low income;
E	**PROMOTE RENEWABLES** which incents renewables at all scales (from utility size to residential) to meet growing or existing consumer demand for renewable energy.

MODELING ASSUMPTIONS AND CANDIDATE TECHNOLOGIES

TVA uses an industry standard model to derive an optimal capacity plan, considering the focus of each strategy evaluated in each scenario. Modeling assumptions, the framework of IRP planning, are the constraints and planning guidelines that are put into the model. The reliability constraint is especially critical, as it ensures we have enough capacity at all times to provide reliable electricity to customers. For the 2019 IRP, it also is crucial to understand how the system would operate with more renewables and DER on the system – driving a greater need for operational flexibility. TVA considered a broader range of mature and emerging technologies in this IRP, including some distributed energy technologies.

STAKEHOLDER & PUBLIC INVOLVEMENT

Throughout the IRP process, TVA engaged external stakeholders to understand diverse opinions and to challenge assumptions. TVA established the IRP Working Group, whose 20 members represent diverse interests in the Valley. The IRP Working Group met approximately monthly to review input assumptions and preliminary results and to enable its members to provide their respective views to TVA. TVA also presented IRP progress updates to the Regional Energy Resource Council (RERC), a federal advisory committee that provides advice to the TVA Board of Directors on a range of energy-related matters, including the IRP.

During a 60-day scoping period from February 15 through April 16, 2018, TVA obtained public comments on the scope of the effort to develop this IRP, which helped shape the draft IRP and EIS. After the release of the draft IRP and EIS on February 15, 2019, TVA provided a public comment period through April 8, 2019. TVA held meetings across the Tennessee Valley and an online webinar, and accepted public comments via mail, email, online and in-person at the meetings. Input was critical in shaping the IRP and EIS, and many of the sensitivity analyses that were performed were informed by stakeholder and public input.

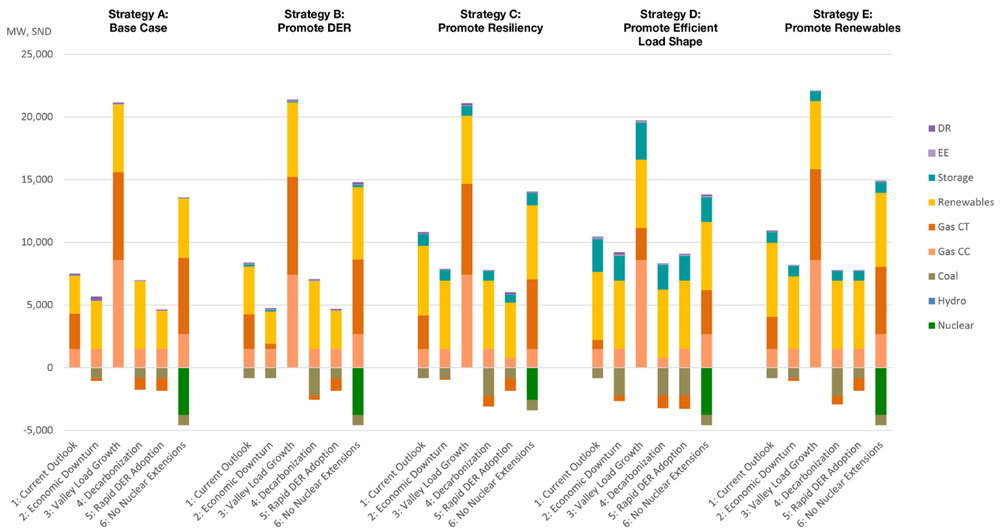
The IRP Working Group included representatives from:

- State and local governments
- Academia and research groups
- Advocacy groups
- Local power companies (LPCs)
- Economic development organizations
- Directly-served/ industrial customers

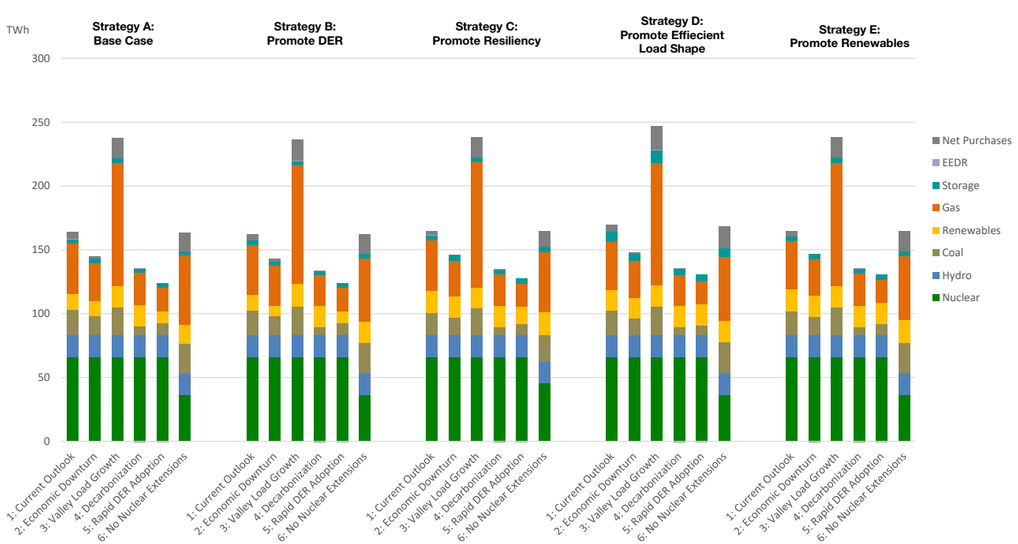
Developing the IRP

EVALUATING THE PORTFOLIOS

Incremental capacity by 2038 consists of additions of new energy resources and retirement of existing energy resources for the portfolios associated with each strategy.



Total Energy in 2038 by resource type in the portfolios associated with each strategy.



EVALUATING THE PORTFOLIOS

Each IRP case represents a combination of expectations about the future environment TVA operates in and potential strategies TVA could employ that result in unique resource portfolios. The modeling process resulted in 30 resource portfolios. The model analyzed how to achieve the lowest-cost portfolio with each strategy in each scenario, looking for the optimal solution within that particular combination. With input from the IRP Working Group and RERC, TVA identified 14 metrics that reflect desired goals and priorities in areas related to cost, risk, environmental stewardship, operational flexibility and Valley economics. The metrics were used to evaluate tradeoffs among the 30 resource portfolios.

Strategy Performance

	COST	RISK	ENVIRONMENTAL STEWARDSHIP		OPERATIONAL FLEXIBILITY	VALLEY ECONOMICS
			CO_2, Water, Waste	Land Use		
STRATEGY A: BASE CASE						All strategies have similar impacts on the Valley economy as measured by per capita income and employment
STRATEGY B: PROMOTE DER						
STRATEGY C: PROMOTE RESILIENCY						
STRATEGY D: PROMOTE EFFICIENT LOAD SHAPE						
STRATEGY E: PROMOTE RENEWABLES						

Good — Better — Best

Developing the IRP

SENSITIVITY ANALYSIS

When analyzing results from the draft IRP, TVA identified issues that warranted further evaluation prior to finalizing the study. In addition, TVA received helpful input from the IRP Working Group and the RERC, as well as from the public during the comment period. Many of the questions raised by TVA, stakeholders and the public focused on certain key assumptions that could influence results. To explore the impacts of changes in key assumptions and to inform the Recommendation, TVA evaluated sensitivities related to the following categories: natural gas prices; storage, wind, combined heat and power (CHP) and small modular reactor (SMR) capital costs; greater energy efficiency (EE) and demand response (DR) market depth; integration cost and flexibility benefit; pace and magnitude of solar additions; higher operating costs for coal plants; more stringent carbon constraints; and variation in climate.

Summary of 2019 IRP Sensitivities

SENSITIVITY CASE Base Case comparison is the Current Outlook unless otherwise noted	CAPACITY EXPANSION IMPACTS BY 2038 GREEN indicates increase and RED indicated decrease in resource						
	NUCLEAR	COAL	GAS	HYDRO	SOLAR	WIND	EEDR
Higher Natural Gas Prices				+55 MW	+2,050 MW		
Lower Natural Gas Prices			2,000 MW CT replaced by CC		-5,900 MW		
Lower Wind Costs			-1,100 MW		-3,100 MW	+4,200 MW	
Greater EE & DR Market Depth			-2,000 MW		-2,200 MW		+2,100 MW
Integration Cost & Flexibility Benefit			Minor timing differences		Minor timing differences		
Pace & Magnitude of Solar Additions					+1,100 MW		
Magnitude of Solar Additions (Valley Load Growth)			1,000 MW CC replaced by CT		+6,000 MW		
Higher Operating Costs for Coal Plants		-2,200 MW	+1,500 MW				
More Stringent Carbon Constraints (Decarbonization)		-2,000 MW accelerated	CC expansion accelerated	+175 MW			
Variation in Climate	Summer derates	Summer derates	CT expansion accelerated		+2,100 MW		

Note

- **Impacts shown in Summer Net Dependable MW, except for solar and wind that are shown in nameplate MW**

FORMING THE IRP RECOMMENDATION

The IRP results — including the 30 primary cases and the sensitivity cases — provide a robust set of potential resource additions and retirements. The final Recommendation is derived from this evaluation. The Recommendation takes into account customer priorities around power cost and reliability across different futures, along with environmental stewardship and Valley economics considerations. In developing a recommendation from the study, TVA elected to establish guideline ranges for key resource types (owned or contracted) that make up the target power supply mix. In order to distill the considerable number of cases evaluated through the original scenario and strategy analysis and the sensitivity cases, the Recommendation uses ranges that are centered on results obtained under the Current Outlook scenario. The other scenario and sensitivity results provide a sense of how the target power supply mix might change as the future changes. Recognizing that a variety of future scenarios are possible and each strategy has positive aspects, all IRP results are included in the Recommendation to provide flexibility for how the future evolves. Implementing the least-cost resource plan with all of these priorities in mind will help ensure TVA continues to fulfill its mission to serve the people of the Tennessee Valley.

The IRP and the Tennessee Valley Environment

PURPOSE OF THE EIS

TVA's EIS assesses the natural, cultural and socioeconomic impacts associated with the 2019 IRP. The five strategies are the basis for the alternatives discussed in the EIS. The Base Case serves as the No-Action Alternative, and the remaining four strategies are the Action Alternatives. The draft EIS analyzed and identified the relationship of the natural and human environment to each of the five alternative strategies. The final EIS includes an additional alternative, the 2019 Recommendation (Target Power Supply Mix). The portfolios associated with each of the five alternative strategies, as well as the 2019 Recommendation, are quantitatively and qualitatively evaluated to determine the environmental impact. This evaluation addresses systemwide topics, including

- Greenhouse gas emissions
- Fuel consumption
- Air quality
- Water quality and quantity
- Waste generation and disposal
- Land requirements
- Socioeconomic impacts
- Environmental justice.

Public comments on the draft EIS and draft IRP are addressed in the final EIS.

The primary study area described in the EIS includes the combined TVA service area; the Tennessee River watershed; and parts of the Cumberland, Mississippi, Green and Ohio Rivers in TVA's power service area. For some resources, such as air quality and climate change, the assessment area extends beyond the TVA region. For some socioeconomic resources, the study area consists of the 170 counties where TVA is a major provider of electric power and/or operates generating facilities.

The IRP and the Tennessee Valley Environment

ENVIRONMENTAL IMPACTS OF THE 2019 IRP

Under all the portfolios and the 2019 Recommendation, there is a need for new capacity, with a significant expansion of solar generation overall. Uncertainty around future environmental standards for carbon dioxide emissions, along with the outlook for loads and gas prices, are key considerations when evaluating potential coal retirements. Emissions of air pollutants, the intensity of greenhouse gas emissions (CO_2 intensity) and generation of coal waste decrease under all strategies. Strategies focused on resiliency, load shape and renewables have the largest amounts of solar and storage expansion and coal retirements, resulting in lower environmental impact overall but higher land use. For most environmental resources, the impacts are greatest for the No Action alternative. The exception is the land area required for new generating facilities, which is greater for the action alternatives, particularly strategies which focus on resiliency, load shape and renewables. Most of this land area would be occupied by solar facilities, which, compared to most other energy resources, have a relatively low level of impact to the land. Additional sensitivity analysis showed the potential for an extended range of resource additions and retirements, which generally resulted in reduced impacts to most environmental resources. The land area occupied by solar facilities, however, could greatly increase.

Conclusion

TVA finds considerable value in undertaking an IRP and EIS, and especially appreciates the input, review and insights of individuals on the IRP Working Group and the Regional Energy Resource Council. They spent considerable time helping TVA develop a robust plan that meets all the criteria outlined in its objectives. TVA values their involvement and the expertise they provided on behalf of their respective stakeholders in making this a better IRP.

As with any long-term plan, TVA's IRP reflects what we know today and can reasonably expect for the coming years. TVA and our employees across the Valley stand ready every day to carry out our three-part mission around energy, the environment and economic development. In an ever-changing world, TVA will do its best to continue to serve the people of the Tennessee Valley by providing low-cost, reliable and clean power in an environmentally responsible manner while promoting economic development across the Valley.

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TVA

Appendix B – TVA Alternatives Evaluation

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Cumberland Retirement EIS: Final Alternatives Evaluation

Enterprise Planning

November 2022

TENNESSEE VALLEY AUTHORITY

TVA Asset Strategy Overview

TVA's asset strategy incorporates the strategic direction from the 2019 Integrated Resource Plan and continues to support affordable, reliable, and cleaner energy for the customers we serve.

Highlights from the asset strategy include:

- Maintaining the existing low-cost, carbon-free nuclear and hydro fleets
- Retiring aging coal units as they reach the end of their useful life, expected by 2035
- Adding 10,000 MW of solar by 2035 to meet customer and system needs, complemented with storage
- Using natural gas to enable needed coal retirements and solar expansion
- Leveraging demand-side options, in partnership with local power companies
- Partnering to develop new carbon-free technologies for deeper decarbonization

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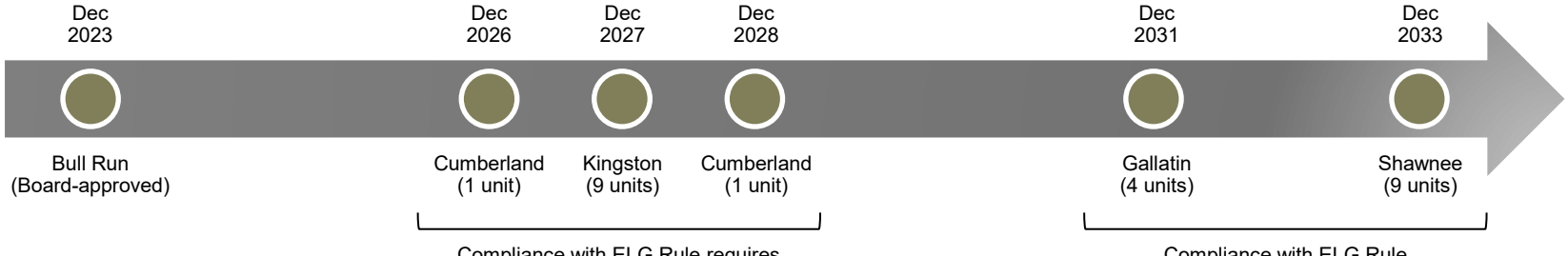
Coal Fleet End-of-Life Evaluations

- The 2019 IRP acknowledged the potential for coal retirements and recommended a near-term action to evaluate end-of-life dates for aging fossil units to inform planning.
- Evaluations assessed the cost, reliability, and environmental implications associated with continued operation of TVA's coal fleet and concluded that it is:
  - Among the oldest in the nation (Cumberland 1973, all other plants 1950s vintage);
  - Experiencing material condition and performance challenges, especially Cumberland and Kingston
  - Projected to have increasing performance challenges due to lack of portfolio fit;
  - Contributing to environmental, economic, and reliability risks
- Retirement planning assumptions were developed based on relative unit condition and fit, as well as the time required to build replacement generation, subject to further evaluation in environmental reviews under the National Environmental Policy Act (NEPA).



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Project Purpose and Need and Project Alternatives

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Cumberland EIS Background and Purpose and Need

TVA's 2019 Integrated Resource Plan (IRP) acknowledged continued operational challenges for the aging coal fleet and included a recommendation to conduct end-of-life evaluations on TVA's remaining coal plants.

TVA's recent evaluations confirm:

- The aging coal fleet is among the oldest in the nation and is experiencing deterioration of material condition and performance challenges.
- TVA has developed planning assumptions for Cumberland Fossil Plant (CUF) unit retirements.
- TVA proposes to retire and decommission the two coal-fired CUF units; one unit by 2026 and the second unit by 2028, and to provide replacement generation that can supply 1,450 MW of firm, dispatchable power by the time the first unit is retired in 2026.

Need for Firm, Dispatchable Power

- The 1,450 MW of replacement generation needed to replace the first retiring unit at Cumberland must be firm, dispatchable power and must be operational before the first Cumberland unit is retired in 2026 so as not to leave TVA short on required generation and capacity to meet system demands and planning reserve margin targets.

- Firm, dispatchable power ensures that TVA can call on the generating capacity year-round, particularly during peak load events – those periods of maximum electricity demand from customers, typically late afternoon in the summer and before or around dawn in the winter.

- Provides a backstop for solar resources that are unable to or are very limited in their ability to meet maximum demand that occurs in the pre-daylight or early-daylight hours of the winter season.

- TVA would need to continue operating the coal-fired units if replacement generation is not in place by 2026.

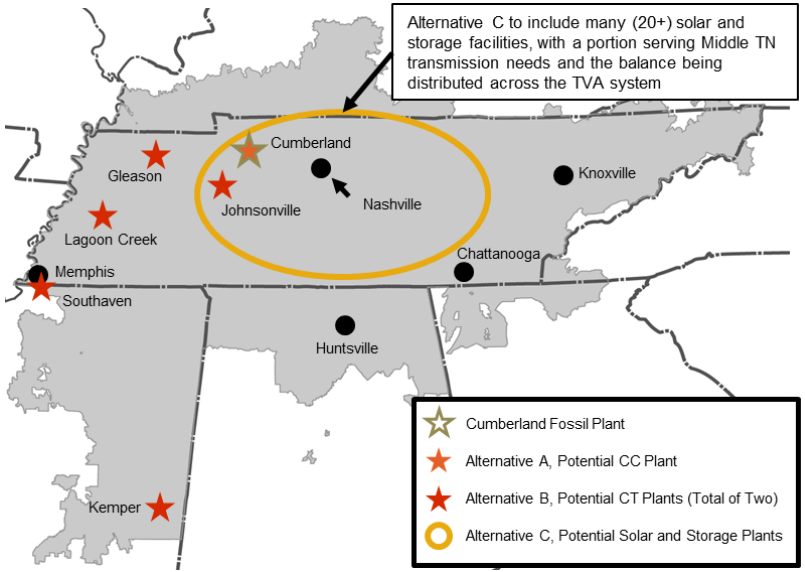
Project Action Alternatives

The Cumberland Fossil Plant (CUF) Retirement EIS includes various action alternatives, in addition to the no action alternative. To recover the generation capacity lost from retirement of the first CUF unit*, TVA staff evaluated the following alternatives for replacement generation:

A Retirement of CUF and construction and operation of a Combined Cycle Combustion Turbine (CC) Gas Plant on the CUF reservation

B Retirement of CUF and construction and operation of Two Simple Cycle Combustion Turbine (CT) Gas Plants at Johnsonville and Gleason

C Retirement of CUF and construction and operation of Solar and Storage Facilities, primarily at alternate locations



*All action alternatives include the demolition of CUF

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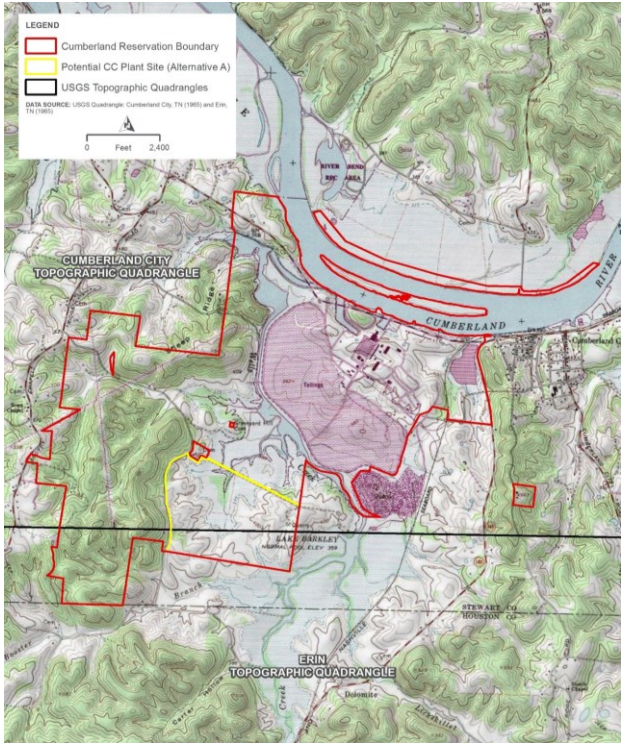
Alternative A: Retire CUF and Construct CC Gas Plant

- Retirement of one CUF unit in 2026 and one CUF unit in 2028 with demolition to follow
- Construction and operation of a Combined Cycle (CC) Gas Plant on the CUF reservation to replace the output of the first unit, with later evaluation for the second unit's replacement
- CC plant would be associated with an estimated 32-mile pipeline lateral to secure fuel supply, with proposed route largely along an existing transmission line corridor
- The construction of the natural gas pipeline(s) under Alternative A would be subject to Federal Energy Regulatory Commission (FERC) jurisdiction and additional review will be taken by FERC in accordance with its own NEPA procedures.



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Alternative A: Combined Cycle Plant at Cumberland

- Combined cycle (CC) plants are effective in baseload or intermediate operations with high fuel efficiency, relatively low construction costs, and flexible operations
- CC plants can provide grid support, follow load, and are fully dispatchable year-round
- The ability of CC plants to ramp up and down throughout the day is increasingly important as TVA integrates 10,000 MW of solar by 2035
- Alternative A includes a 1,450 MW CC plant to recover the dependable capacity of the first retiring CUF unit as well as account for modest load forecast increases
- The Cumberland Reservation offers several key benefits:
  - Existing TVA property
  - Existing transmission interconnection to the TVA system, which can largely be repurposed
  - Nearby to a major interstate natural gas pipeline with adequate capacity and potential to generally locate proposed pipeline lateral along existing transmission line corridor
  - Favorable air permitting prospects

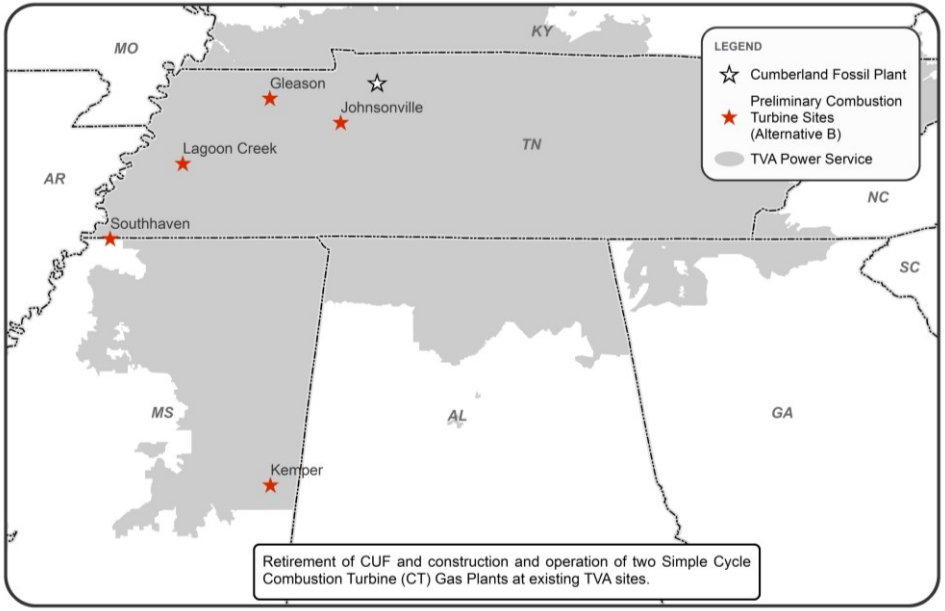
Alternative B: Retire CUF and Construct CT Gas Plants

- Retirement of one CUF unit in 2026 and one CUF unit in 2028 with demolition to follow

- Construction and operation of two Simple Cycle Combustion Turbine (CT) Gas Plants at Johnsonville and Gleason to replace the output of the first unit, with later evaluation for the second unit's replacement

- Preliminary potential locations were TVA brownfield sites with existing gas generation and transmission interconnection

- Sites may require upgrades or expansions to pipeline laterals as well as transmission upgrades for interconnection (evaluations conducted during the EIS indicated an expected duration of 8 to 10 years)



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Alternative B: Combustion Turbine Plants at Johnsonville and Gleason

- Simple cycle combustion turbine (CT) plants are peaking units with the ability to start and ramp quickly, typically have the lowest installed capital cost per MW, and offer flexible operations
- CT plants can provide grid support and are fully dispatchable year-round
- CT unit flexibility and dispatchability is increasingly important as TVA integrates 10,000 MW of solar by 2035
- Alternative B includes two CT plants with a combined total of 1,530 MW to recover the dependable capacity of the first retiring CUF unit as well as account for modest load forecast increases
- The Johnsonville and Gleason Reservations offer several benefits:
  - Existing TVA property
  - Existing transmission interconnection to the TVA system, which can reduce costs to interconnect new facilities
  - Existing natural gas pipeline infrastructure which can be used or upgraded to supply additional generation

Alternative C: Retire CUF and Construct Solar & Storage

- Retirement of one CUF unit in 2026 and one CUF unit in 2028 with demolition to follow
- Construction and operation of many (likely 20+) solar and storage facilities to replace the generation and capacity of the first unit, with later evaluation for the second unit's replacement
- Alternative uses generic site analysis and assumes procurement via competitive request for proposal (RFP) process with a power purchase agreement (PPA) structure*, subject to site-specific NEPA review
- It is anticipated that a portion of the storage facilities will need to be located in Middle Tennessee for regional grid support, with the balance located elsewhere in the Valley

*If this alternative is selected a portion of these facilities could be TVA constructed and operated as well, subject to site-specific NEPA review

Alternative C: Solar and Battery Storage Facilities

- Solar resources are becoming more competitive on a cost per MWh basis; however, they are not dispatchable and generation is intermittent in nature, varying by time of day, weather, and season
- Solar additions tied to a replacement of the first CUF unit would need to be in addition to the 10,000 MW already included in TVA's base plans
- In order to provide dependable peak capacity needs for the TVA system, solar generation must be paired with dispatchable resources, such as storage or gas
- Battery energy storage systems (BESS) typically represent one of the lowest cost storage options today, with four-hour BESS systems providing a reasonable balance of price, output, and duration
- The combination of utility-scale solar and battery storage would provide a carbon-free alternative to replace the energy and capacity of the first CUF unit
- Alternative C includes 3,000 MW of solar and 1,700 MW of battery storage to recover the generation and dependable capacity of the first retiring CUF unit as well as account for modest load forecast increases
- Sites will require interconnection and transmission work (evaluations conducted during the EIS indicated an expected duration 9 to 11 years)

Alternative C Development

- Solar evaluation
  - TVA Staff began by replacing the average annual energy output of a CUF unit with solar, with consideration for differences in annual capacity factor
  - Analysis indicated a need for 3,000 MW of additional solar to replace the annual energy of the first CUF unit, on top of the 10,000 MW of solar already included in the base plan

- Storage evaluation
  - The TVA system is dual-peaking, meaning that it experiences peak loads in both summer (typically late afternoon) and winter (typically early morning, just before dawn)
  - Battery storage (typically lithium-ion) is currently the lowest cost option for additional storage capacity, which would ensure TVA's winter capacity reserves are maintained with the retirement of the first CUF unit
  - Storage systems are energy-limited, with typical utility-scale battery systems configured for 4 hours at full output
  - TVA staff utilized the SERVM model to determine what level of storage would maintain industry standard reliability of 1 Loss-of-Load-Event (LOLE) in 10 years, with risk spread equally between summer and winter
  - Analysis indicates that 1,700 MW of battery energy storage, paired with 3,000 MW of additional solar capacity, will maintain a 0.1 LOLE with balanced seasonal risk with the retirement of a CUF unit

Alternatives Considered, but Dismissed

Resource Option	Reasoning
Hydro Pumped Storage	Longer timelines to meet environmental requirements and for construction fail to meet 2026 timeline for the first unit retirement at CUF. Long-duration storage technology that is currently being studied by TVA for further evaluation and potential deployment in the early 2030s.
Small Modular Reactors (SMR)	Longer construction timeline and first of kind deployment risks fail to meet 2026 timeline for this project. Potential to serve cost-effective baseload or load following needs in the future with low fuel costs, carbon-free generation, advanced passive safety systems, and anticipated cost reductions achieved by assembling components in a factory setting.
In- and/or Out-of-Valley Wind	Not selected due to low wind speeds in Tennessee Valley and higher transmission costs for out-of-Valley wind, both of which increase relative costs. Wind can provide dependable capacity in both summer and winter, though intermittent.
Energy Efficiency (EE)	Dismissed as EE programs take time to scale and market, while also facing increasing costs for higher depth and penetration levels. EE is well-positioned to help TVA absorb load growth resulting from increased electrification of the economy in the future.
Demand Response (DR)	Dismissed as they are limited in the number of calls available and do not provide reliable firm, dispatchable power. DR can help TVA absorb load growth resulting from increased electrification of the economy and allow TVA to offset physical capacity needs.

Distributed generation (e.g., distributed solar, storage, and/or wind) was also considered, however the cost for distributed generation is generally higher than utility-scale generation for the same type of resource. TVA has therefore determined that the combination solution of utility-scale solar paired with utility-scale storage as presented in Alternative C provides a feasible lower-cost solution.

Evaluation Results and Preferred Alternative

Evaluation Approach

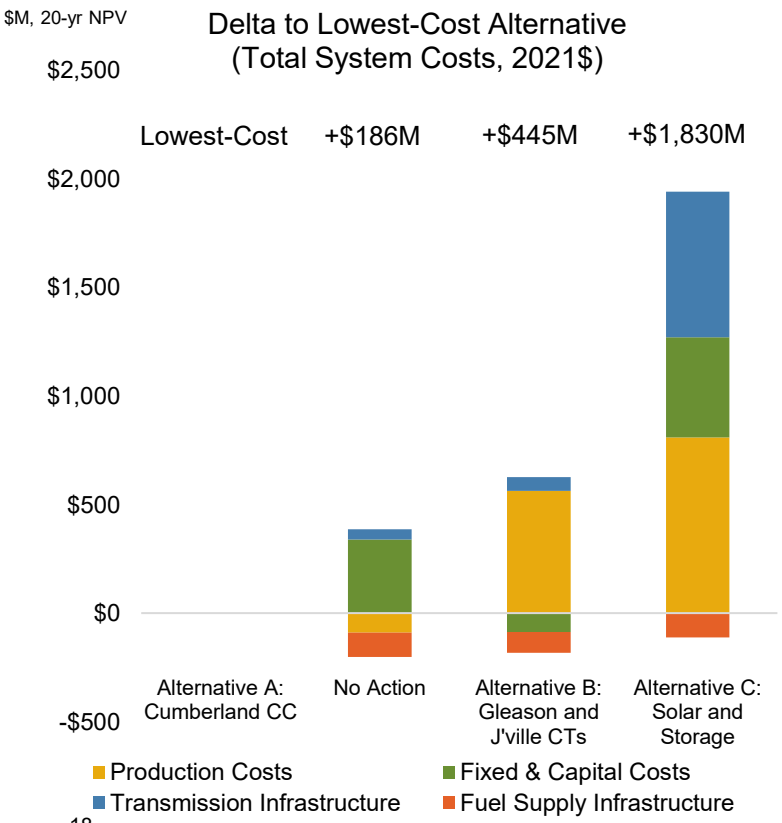
TVA staff utilized the FY22 Budget Power Supply Plan as the basis for the CUF Retirement EIS Alternatives analysis. For each alternative, a 20-year study was performed using expansion and production cost models (System Optimizer and Aurora, respectively).

Alternative	Retirements*	First CUF Replacement^
No Action	• No CUF retirements	• N/A
Alternative A	• 12/31/2026: CUF, 1 unit • 12/31/2028: CUF, 1 unit	• Cumberland CC (1,453 MW, Summer)
Alternative B	• 12/31/2026: CUF, 1 unit • 12/31/2028: CUF, 1 unit	• Johnsonville CT (875 MW, Summer) and Gleason CT (656 MW, Summer)
Alternative C	• 12/31/2026: CUF, 1 unit • 12/31/2028: CUF, 1 unit	• Solar PPA (3,000 MW) and Battery Storage (1,700 MW) • Projects are assumed to come online in phases over three years for modeling purposes

**Retirement dates are assumed to on or before December 31st of the year indicated, replacement project must be in place at the time of retirement*

^Replacement generation for the second CUF unit will be further studied in a subsequent review, this study includes planning assumptions from the FY22 Budget

Total System Costs Comparison



Total system costs includes all capital, fixed, variable, and fuel costs associated with running the TVA system, as well as spending for requisite pipeline and transmission upgrades in each alternative

Alternative	Production Costs^	Fixed & Capital Costs	Transmission Infrastructure	Fuel Supply Infrastructure	Miscellaneous
Alternative A: Cumberland CC (Lowest-Cost)	Efficient CC is the lowest-cost alternative and meets the Purpose and Need of this project; included are costs associated with CC plant construction and operation, limited transmission upgrades, and pipeline lateral construction.				
No Action Alternative	↓ Lower driven by resource type fuel cost differences	↑ Higher driven by maintaining reliability of CUF units and regulatory compliance (e.g., ELG Rule*)	↑ Higher driven by upgrades required to maintain dynamic stability with planned solar by 2027	↓ Lower as this is not applicable	Substantial risks related to evolving and future regulatory requirements and plant material condition
Alternative B: Gleason and Johnsonville CTs	↑ Higher driven by less fuel-efficient replacement resources	↓ Lower driven by less expensive replacement resources	↑ Higher driven by interconnection at alternate sites and regional upgrades with timeline impacts	↓ Lower driven by limited fuel supply upgrades required at existing facilities	Required 500kV upgrades fail to meet 2026 timeline by 2-to-4+ years and higher costs for reliability and environmental compliance at CUF
Alternative C: Solar and Storage	↑ Higher driven by remaining coal/gas units being less fuel efficient and integrating additional solar; includes solar resource costs	↑ Higher driven by more expensive battery storage capital and ongoing fixed costs	↑ Higher driven by interconnection of many solar/storage facilities and regional upgrades, both with timeline impacts	↓ Lower as this is not applicable	Solar & storage and transmission projects fail to meet 2026 timeline by 3+ years and higher costs for reliability and environmental compliance at CUF

**Effluent Limitation Guidelines Rule*
^Production Costs include ongoing fuel, start, and variable O&M costs

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Carbon Rate Comparison

- All action alternatives significantly reduce system carbon intensity (lbs/MWh), compared to no action
- The highly efficient advanced-class CC in Alternative A reduces system carbon emissions by offsetting coal generation and by improving the combined fuel efficiency of the entire TVA gas fleet
- The efficient CT units in Alternative B reduce system carbon emissions by offsetting coal generation and by improving the combined fuel efficiency of the TVA peaking gas fleet
- Solar facilities in Alternative C reduce system carbon emissions by offsetting coal and gas generation, however this is partially offset as existing coal and gas units increase generation for battery charging or hours when solar is unavailable
- Once completed, Alternative C results in the lowest system carbon rate, followed closely by Alternative A then B

Alternative	FY30 Carbon Rate (lbs/MWh)*	FY30 Rate Reduction (2005 baseline) Compared to Alternative A*
No Action Alternative	434	-7 percentage points (worse)
Alternative A: Cumberland CC	338	n/a
Alternative B: Gleason and Johnsonville CTs	352	-1 percentage point (worse)
Alternative C: Solar and Storage	321	+1 percentage point (better)

**Vintage: FY22 Budget and associated alternative runs*

Planning is Grounded in Least-Cost Principles

In resource planning, TVA applies fundamental least-cost planning principles*:

Low Cost	Risk Informed	Environmentally Responsible
Reliable & Resilient	Diverse	Flexible

- Load varies hourly and seasonally, with weather a large driver, and highest peak loads are typically of short duration
- Resources have a variety of operational and economic characteristics and constraints, with tradeoffs that contribute to the best portfolio fit overall

**In alignment with the Energy Policy Act of 1992*

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Least-Cost Planning Evaluation

Alternative	Low Cost	Risk Informed	Environmentally Responsible	Reliable & Resilient	Diverse	Flexible
No Action Alternative	Cost risk associated with material condition and environmental compliance	Long-term fuel supply and regulatory risks	Results in highest system carbon rate, continued production of CCRs*	Challenged material condition; dependable year-round capacity	Contributes to balanced portfolio, long-term coal supply chain risks	Designed for baseload operations with little intra-hour flexibility
Alternative A: Cumberland CC	Lowest total system cost, most effective at serving large energy needs	Robust fuel supply chain, potential use of alternative fuels or CCS*, fastest online	Substantial system carbon rate reduction, assists in integration of renewables	Dependable year-round capacity; Middle TN transmission support	Lateral connection to major interstate pipeline with multiple supply sources	Supports baseload or intermediate needs with ability to operate flexibly
Alternative B: Gleason and Johnsonville CTs	Extensive transmission work and less fuel-efficient system overall	Robust fuel supply chain, potential use of alternative fuels; transmission timeline risk	Substantial system carbon rate reduction, assists in integration of renewables	Dependable year-round capacity	Lateral connections to major interstate pipelines with multiple supply sources	Supports peaking needs with fast ramp rates and ability to operate flexibly
Alternative C: Solar and Storage	Highest total system cost; extensive transmission work and large number of solar & storage locations	Timeline risks with transmission build-out and land and resource procurement	Substantial system carbon rate reduction, lowest system carbon rate	Dependable year-round capacity; requires upgrades for dynamic/reactive support; batteries are limited in duration (4 hours)	Contributes to balanced portfolio, adds to aggressive solar build plans	Batteries support fast peaking needs and have a wide operating range

**CCS = Carbon Capture and Sequestration; CCR = Coal Combustion Residuals*

Worst — Worse — Good — Better

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Additional Considerations

- The decision associated with this EIS is a specific, discrete component of TVA's blended Asset Strategy and consistent with the recommended target power supply mix in the 2019 IRP
- New gas contributes to TVA's ~80% carbon reduction by 2035 path by enabling the retirement of the remaining coal plants by 2035, while emitting about 65-70% less CO_2 than aging coal plants
- Natural gas represents a highly flexible, reliable fuel source that helps enable high penetration levels of intermittent renewable resources
- CC plants are positioned to further contribute to a net-zero future using alternative fuels, such as hydrogen, and/or carbon capture and sequestration (CCS) technology
- TVA is exploring partnerships with federal agencies and peer utilities to advance the research and development of both alternative fuels and CCS technology, which could enable their use at existing or future TVA gas facilities
- In support of TVA's plan to add 10,000 MW of solar by 2035, TVA currently has over 2,500 MW of solar either operating or contracted
- TVA is working to gain operational experience with battery storage technology through the deployment of a 20 MW battery storage project near Vonore, TN and nearly 250 MW of storage paired with solar under contract, all planned to be online over the next several years
- TVA is also exploring pilot projects for additional short- and long-duration storage use-cases

Preferred Alternative

- TVA's financial and system analysis, using the least-cost planning framework along with consideration of the environmental impacts of the three alternatives, indicates that Alternative A, retirement of CUF and replacement of the first unit with a CC Plant at the CUF Reservation, is the Preferred Alternative
- Key considerations include:
  - Alternative A aligns with the 2019 IRP near-term actions to evaluate engineering end-of-life dates for aging fossil units to inform long-term planning and to enhance system flexibility to integrate renewables and distributed resources
  - Alternative A is the lowest-cost alternative and supports high reliability while greatly reducing carbon emissions compared to no action
  - Alternative A can be constructed on a TVA-owned brownfield site and largely leverage existing transmission infrastructure
  - Alternative A is a mature technology and can be built and operational sooner than other action alternatives, which reduces economic, reliability, and environmental risks

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Appendix C – Alternative A Pipeline Soils Map

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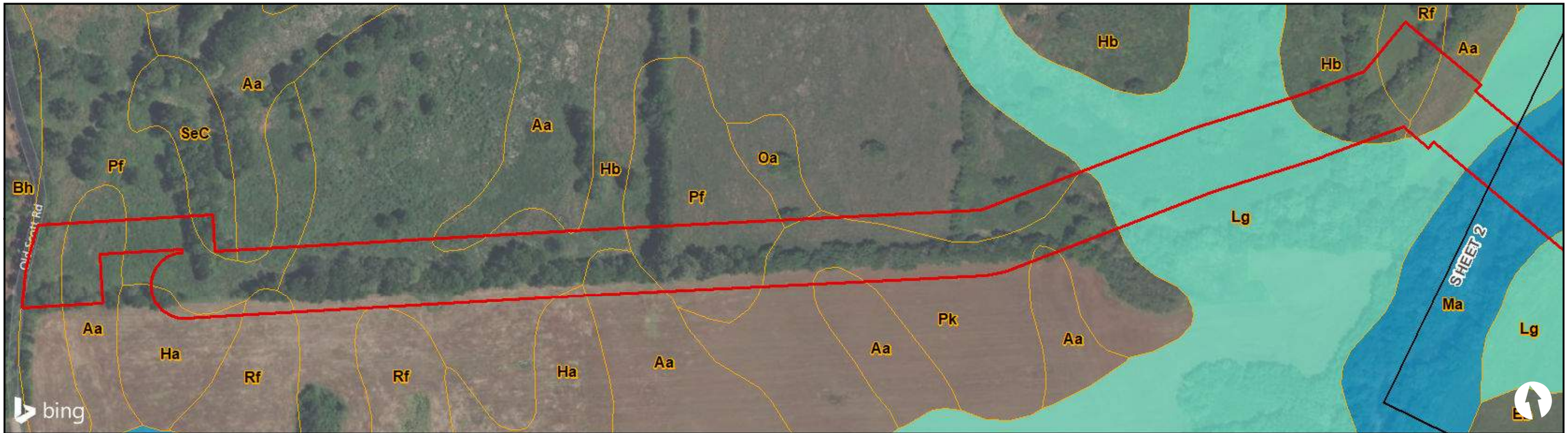

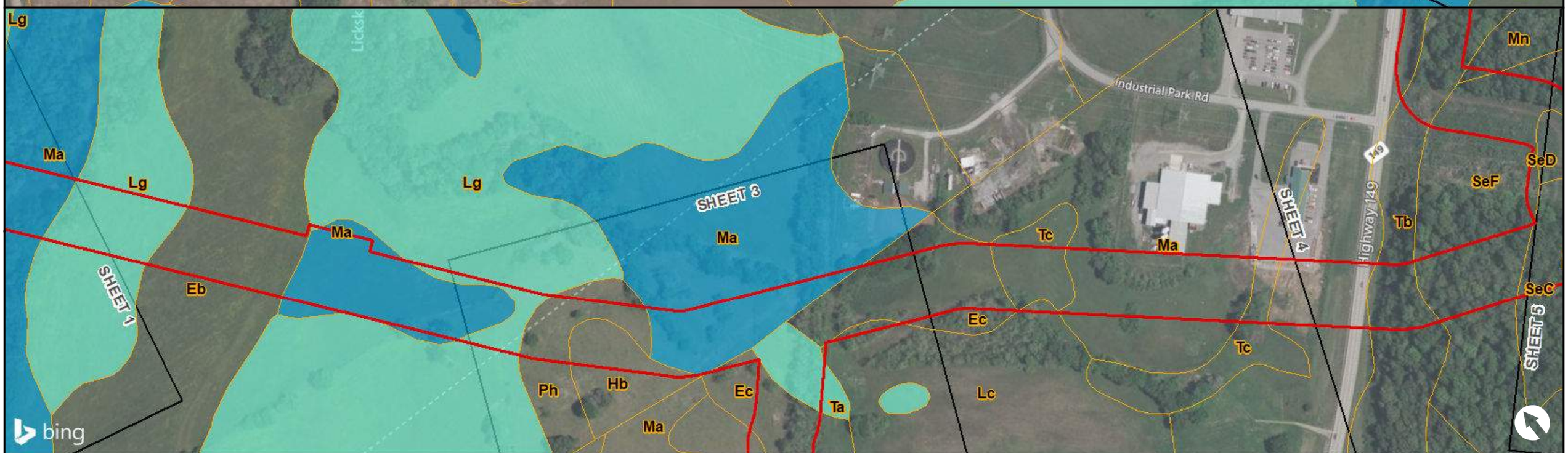

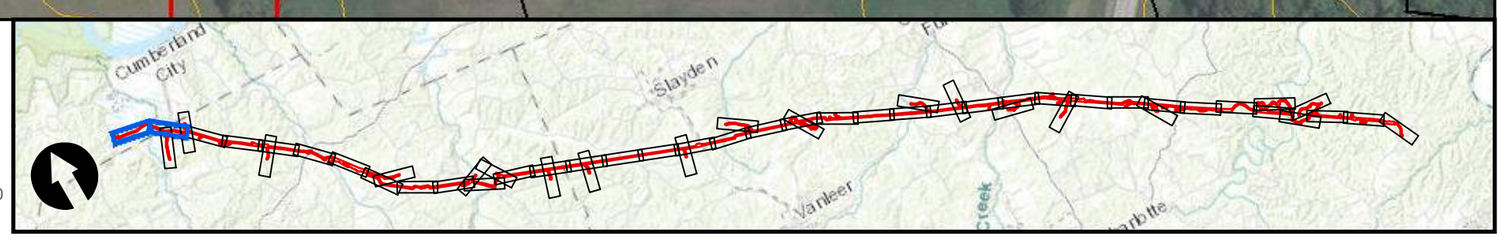

LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

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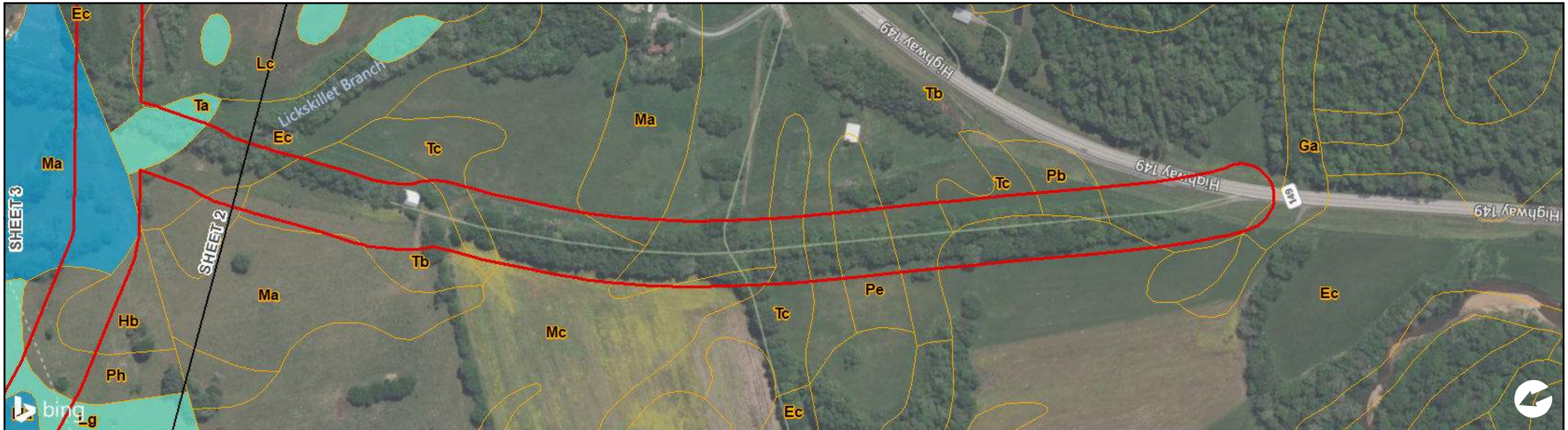
DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery



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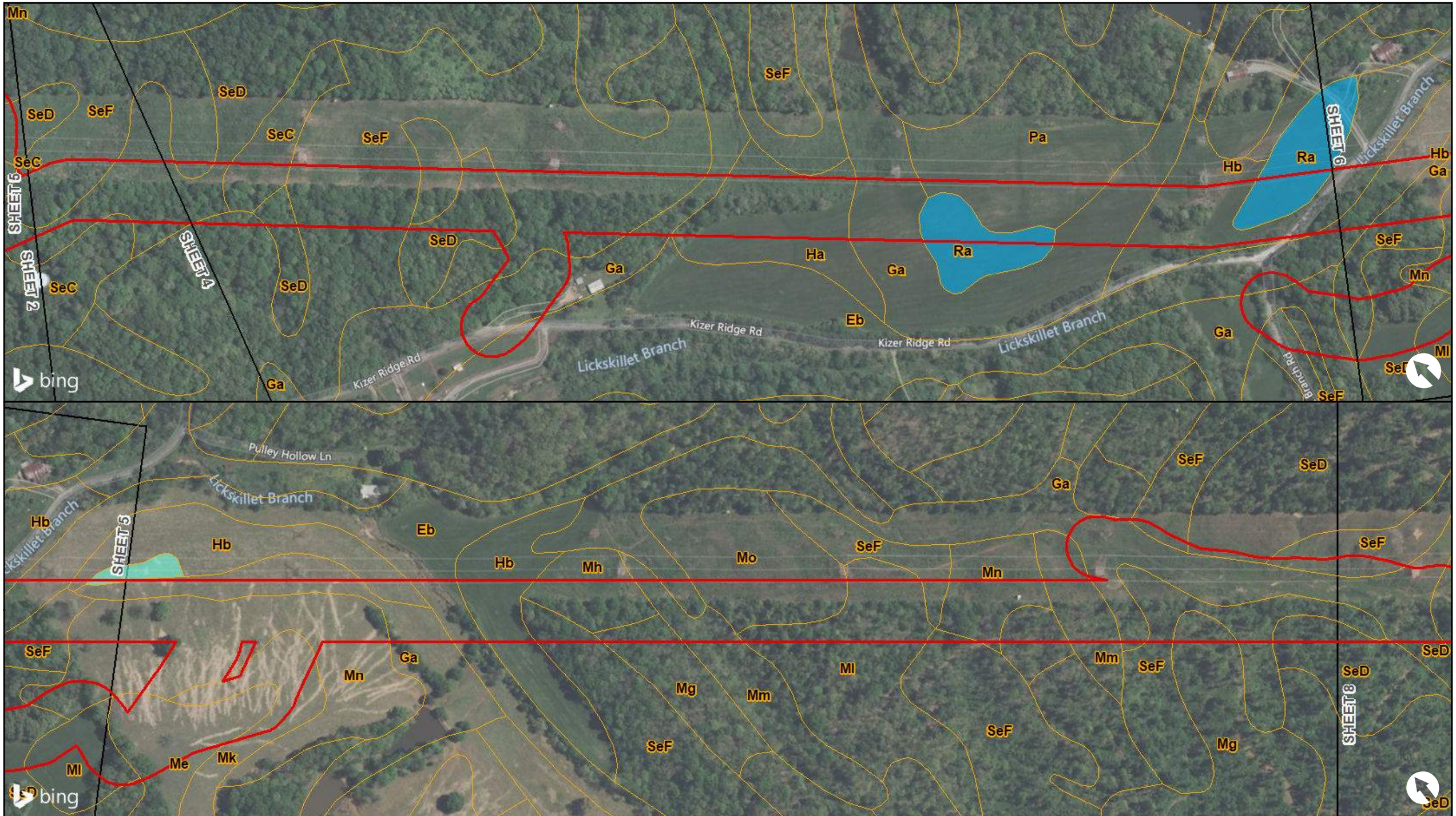

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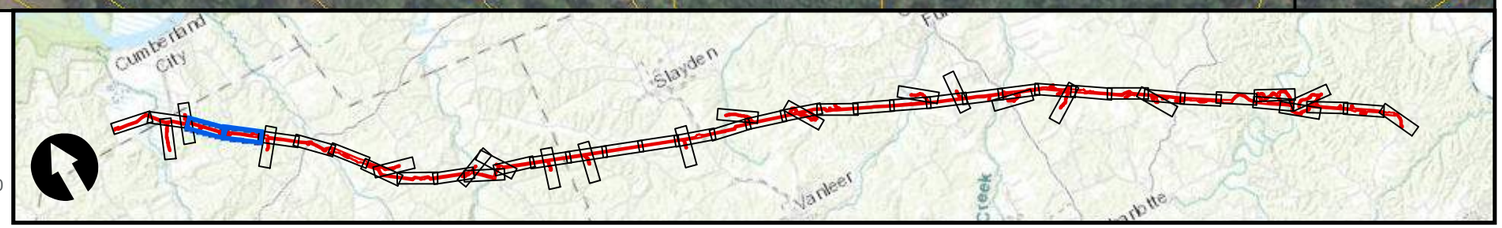

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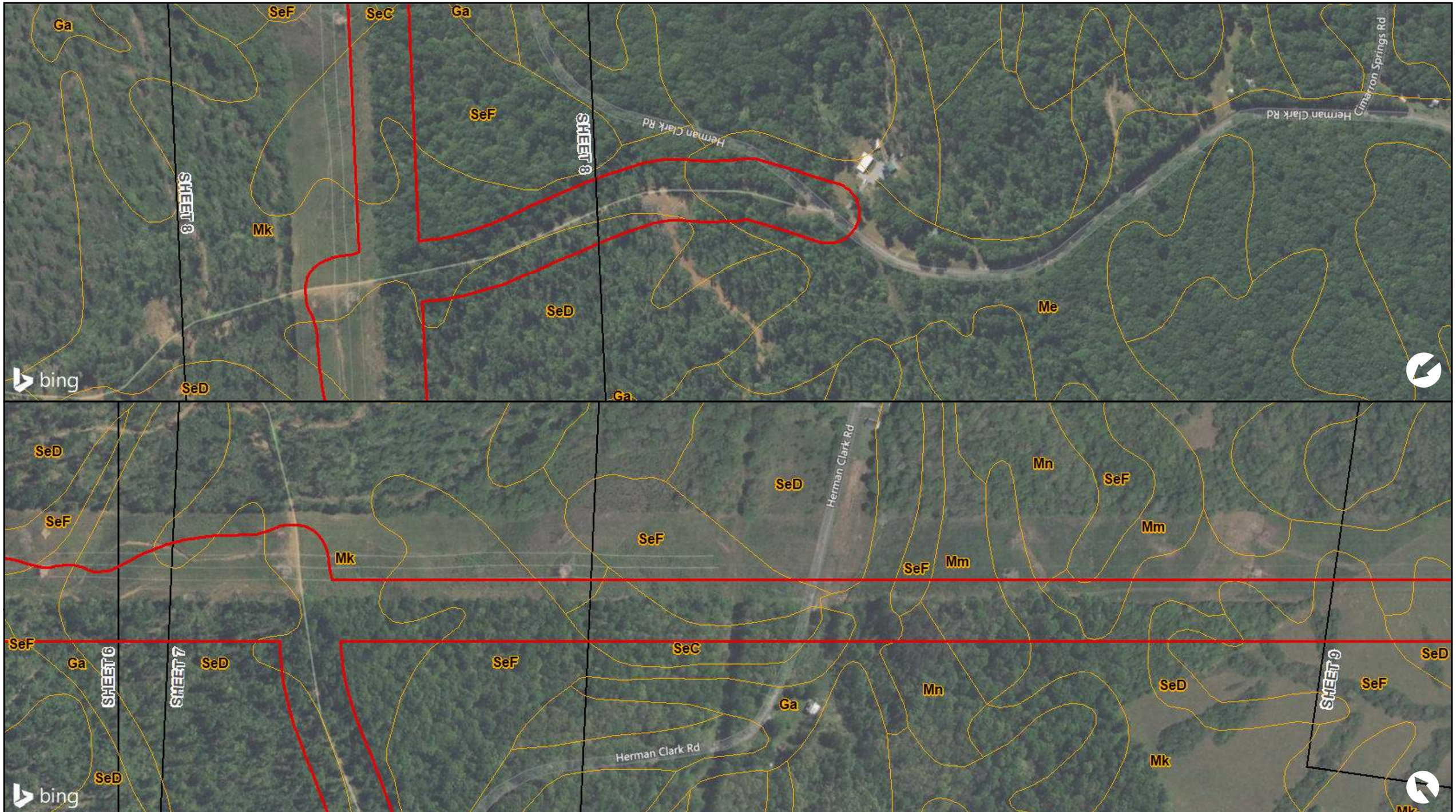

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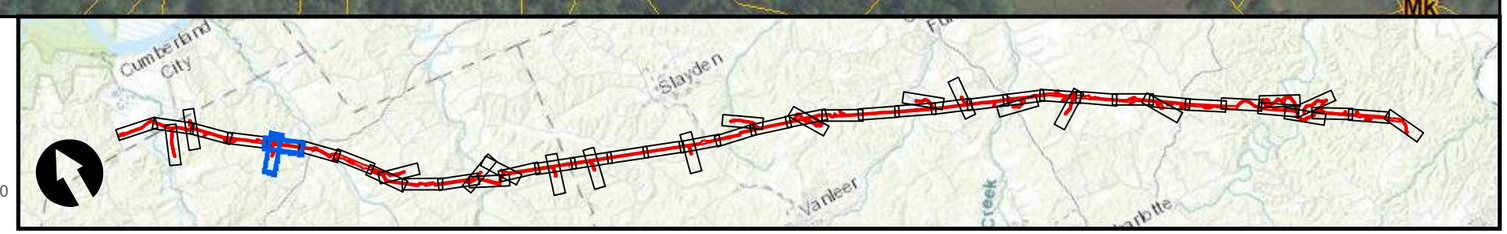

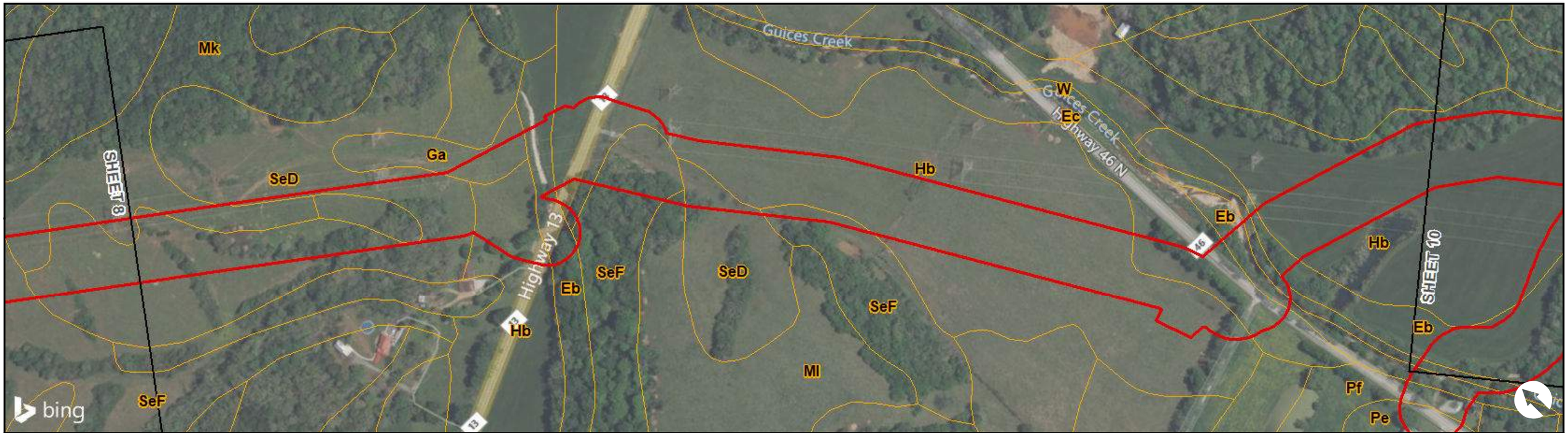

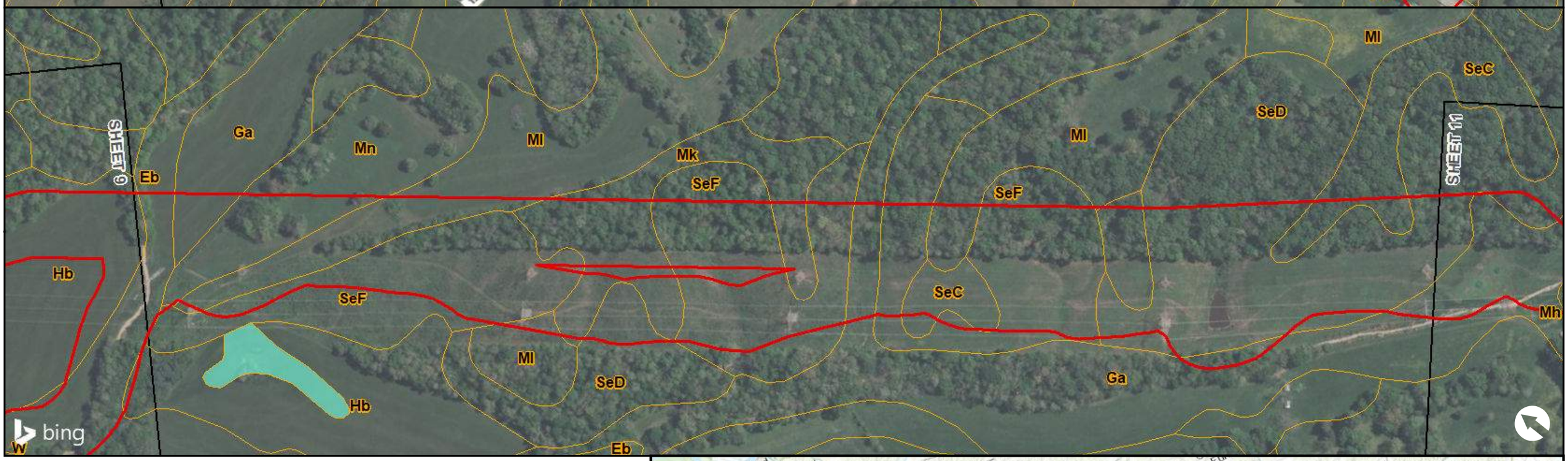

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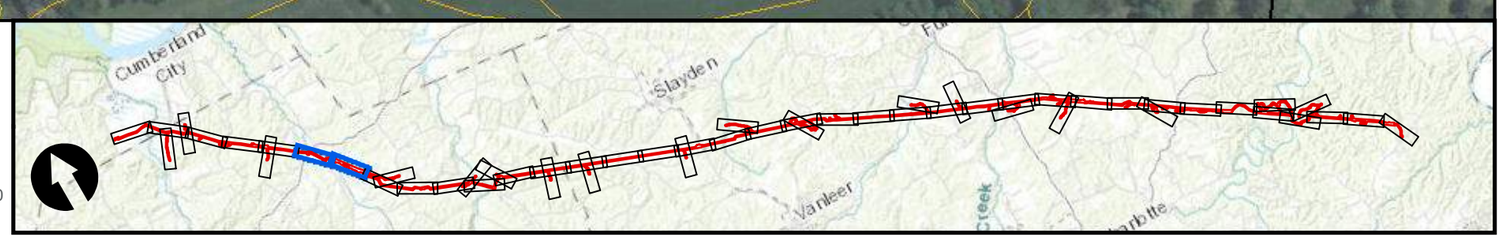

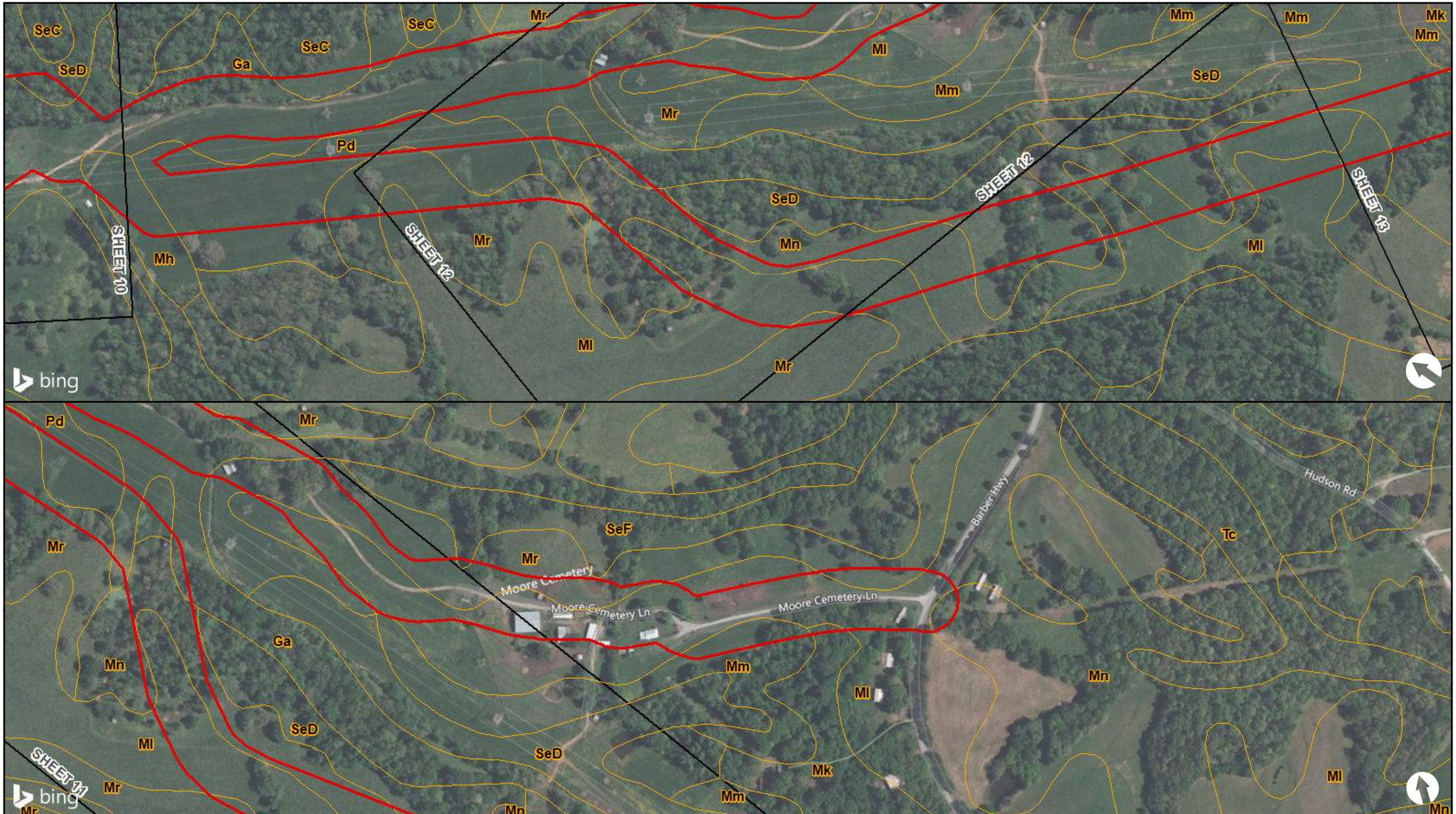

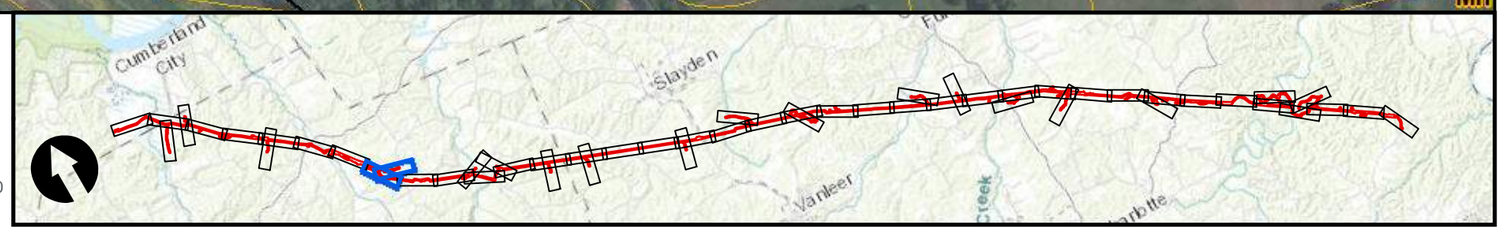

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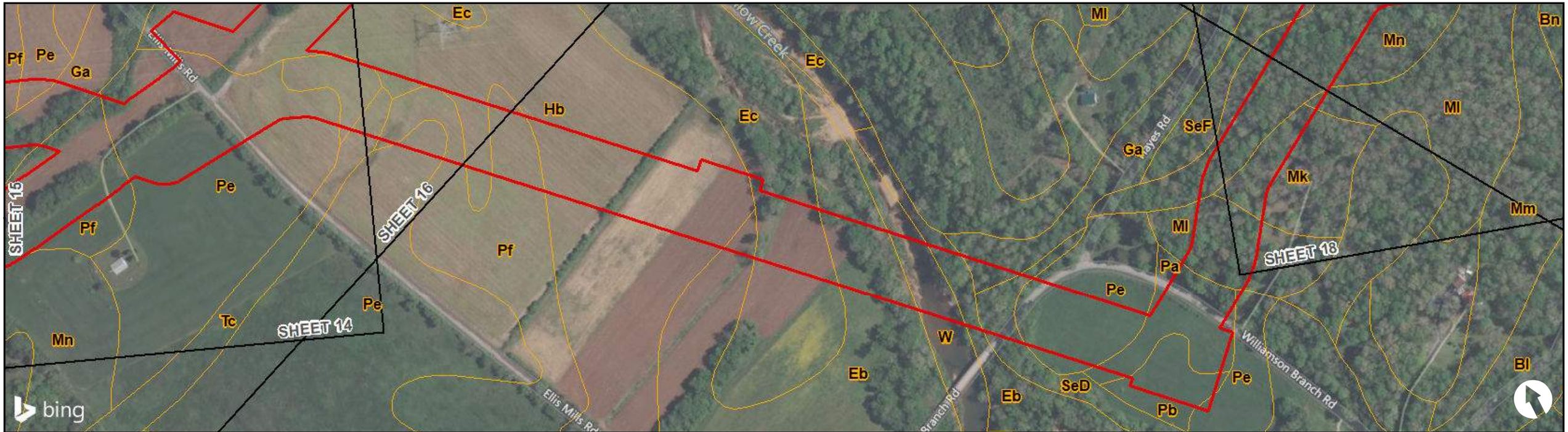
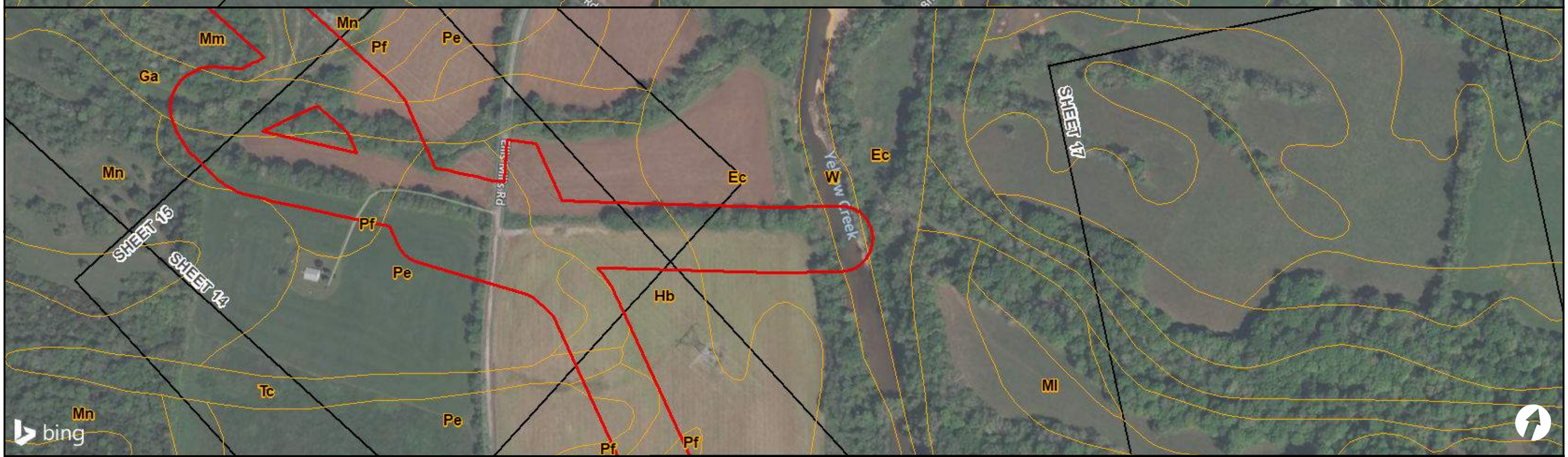


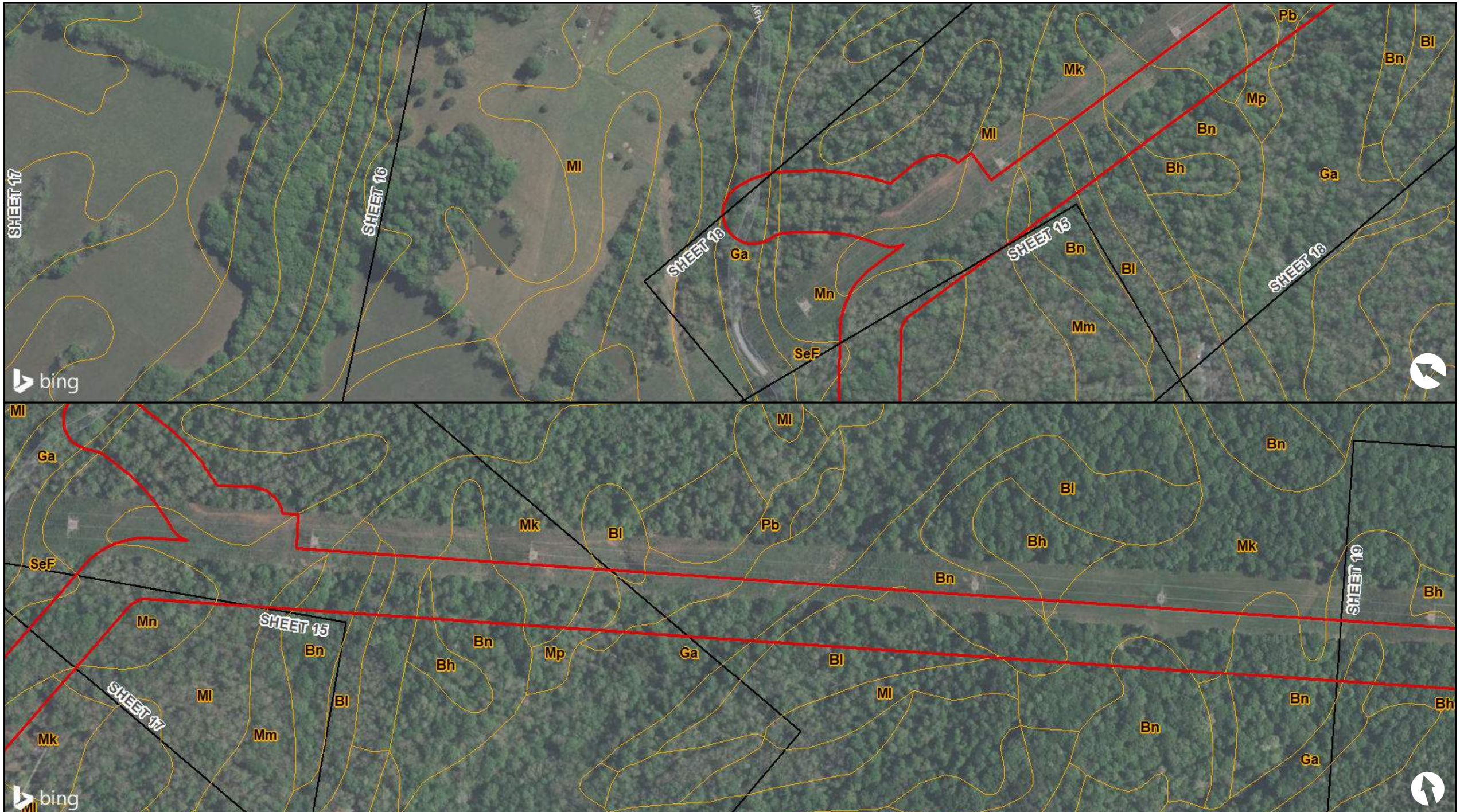


LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery



LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

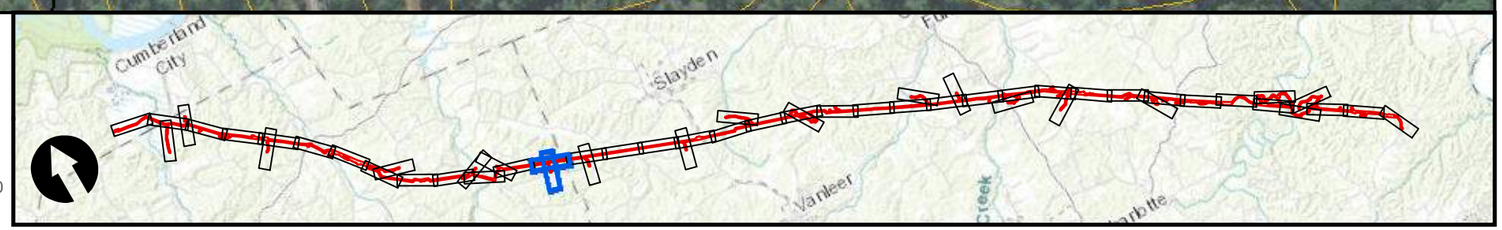
0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

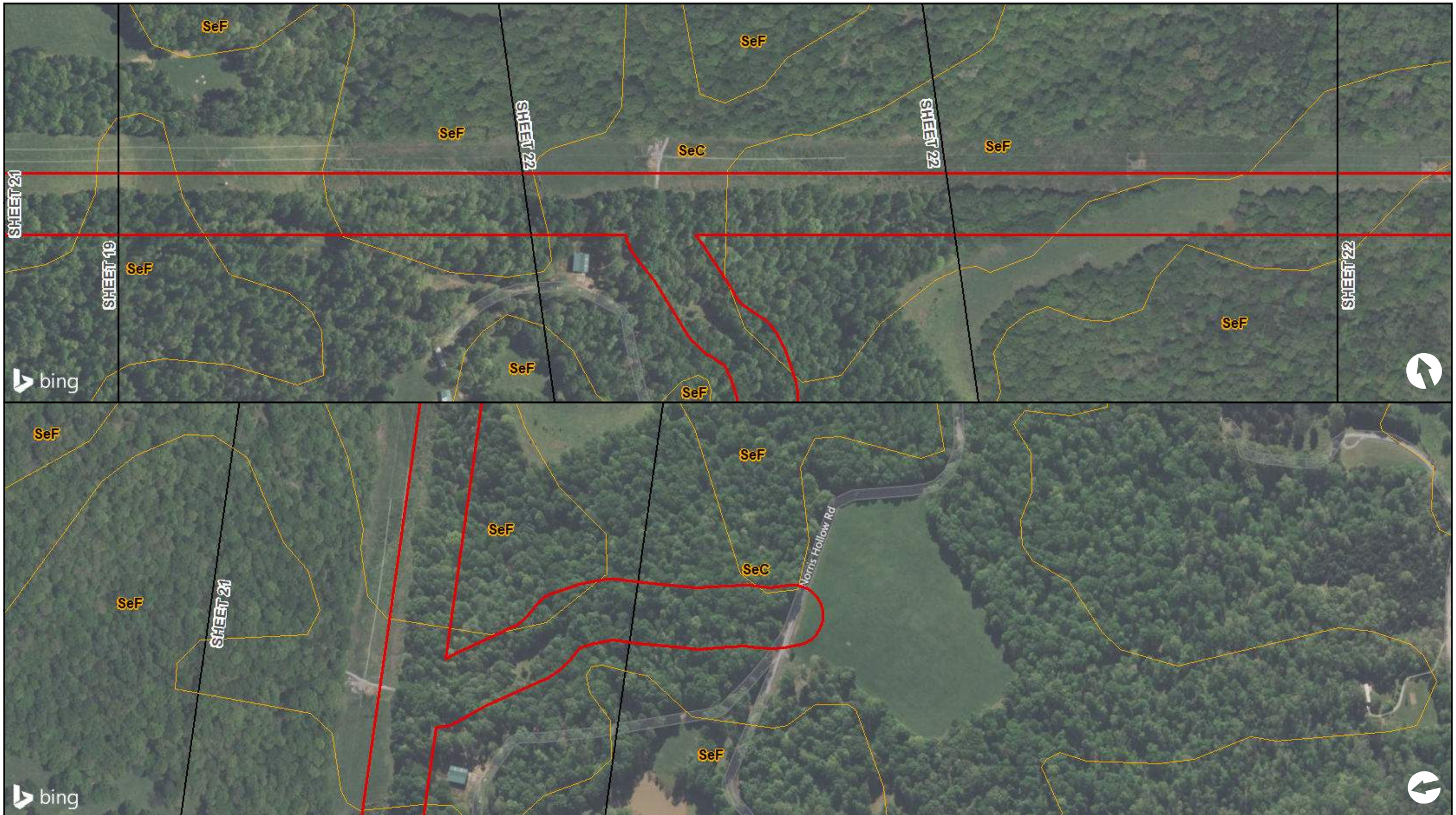
LEGEND

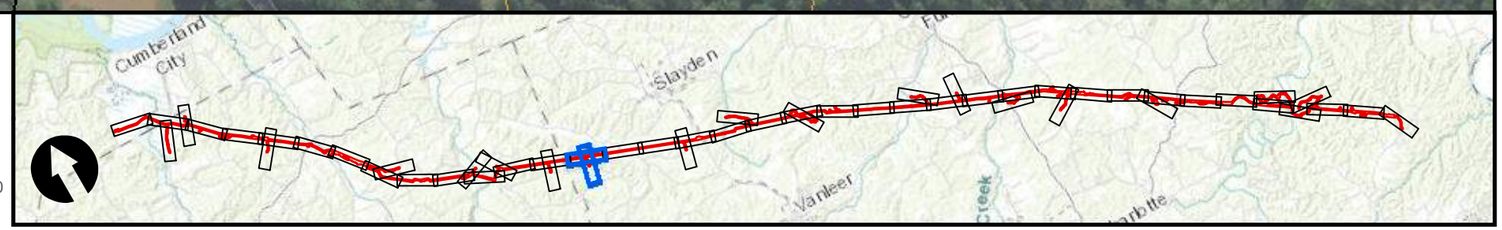
- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300



DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery





LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SeF
SeC
SeF
SeC
SeC
SHEET 23
SHEET 22
SeD2
SeD2
SHEET 24
SeF
SeF
SeF
bing

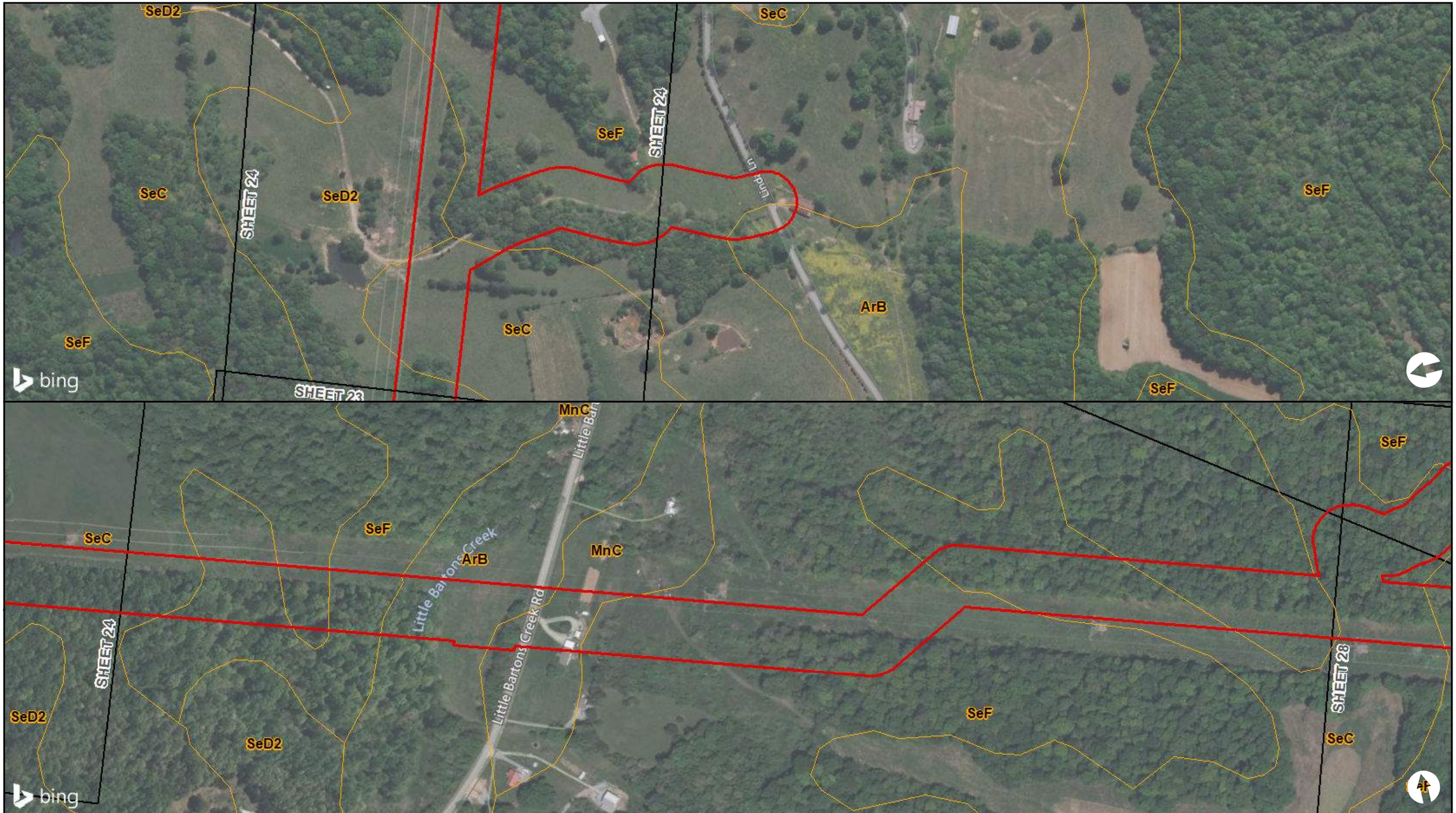
SeC
SeC
SeD2
SHEET 25
SHEET 26
SeC
SHEET 23
SeC
SeF
SeD2
Slayden Marion Rd
bing

LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

0 Feet 300



LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

0 Feet 300

SeC
SeF
SeC
SeC
SeC
SHEET 28
SHEET 30
HuB
Butcher Ridge Rd
SeC
SeF
SHEET 31
SeD2
SHEET 30
SeF
ArB
ArB
ArC
bing

SeF
HuB
SeF
Butcher Ridge Rd
ArC
Dry Hollow Branch
SeC
New Dry Hollow Rd
SeF
ArB
ArA
SHEET 29
SeD2
SeD2
SeF
bing

LEGEND

Alt A Pipeline Corridor

Soil Map Unit

Hydric Rating (1-32%)

Hydric Rating (100%)

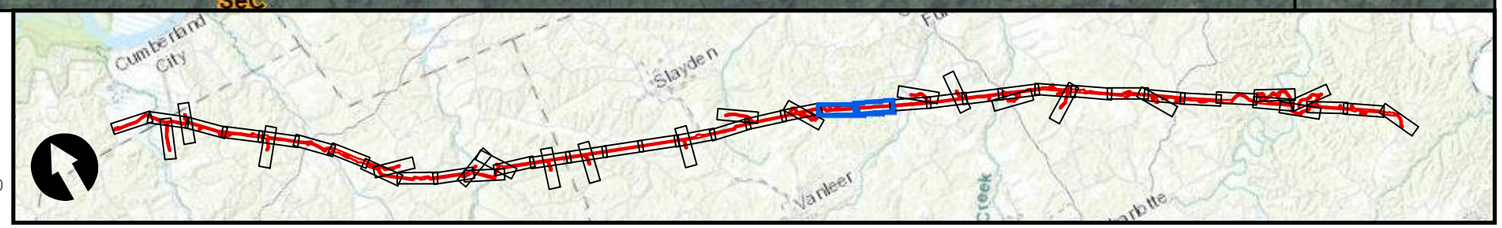
0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300



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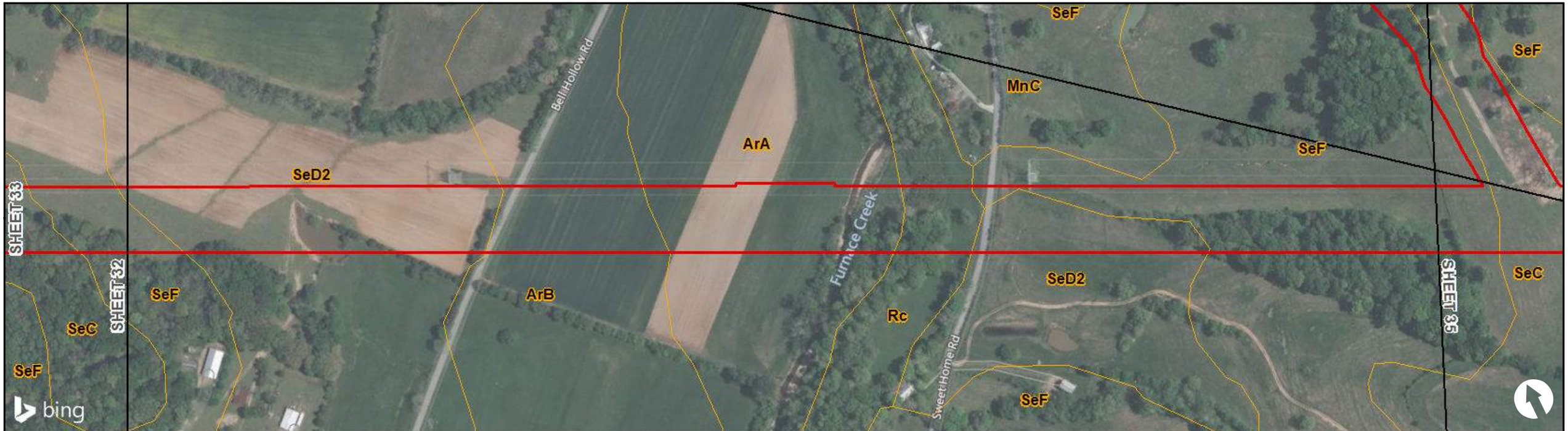
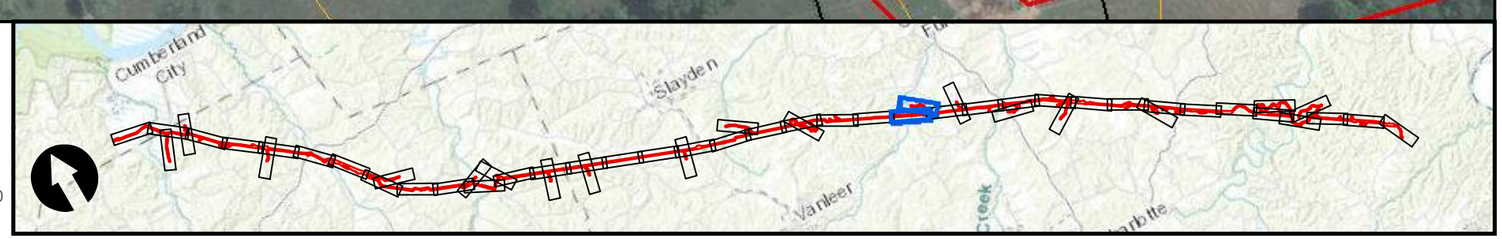


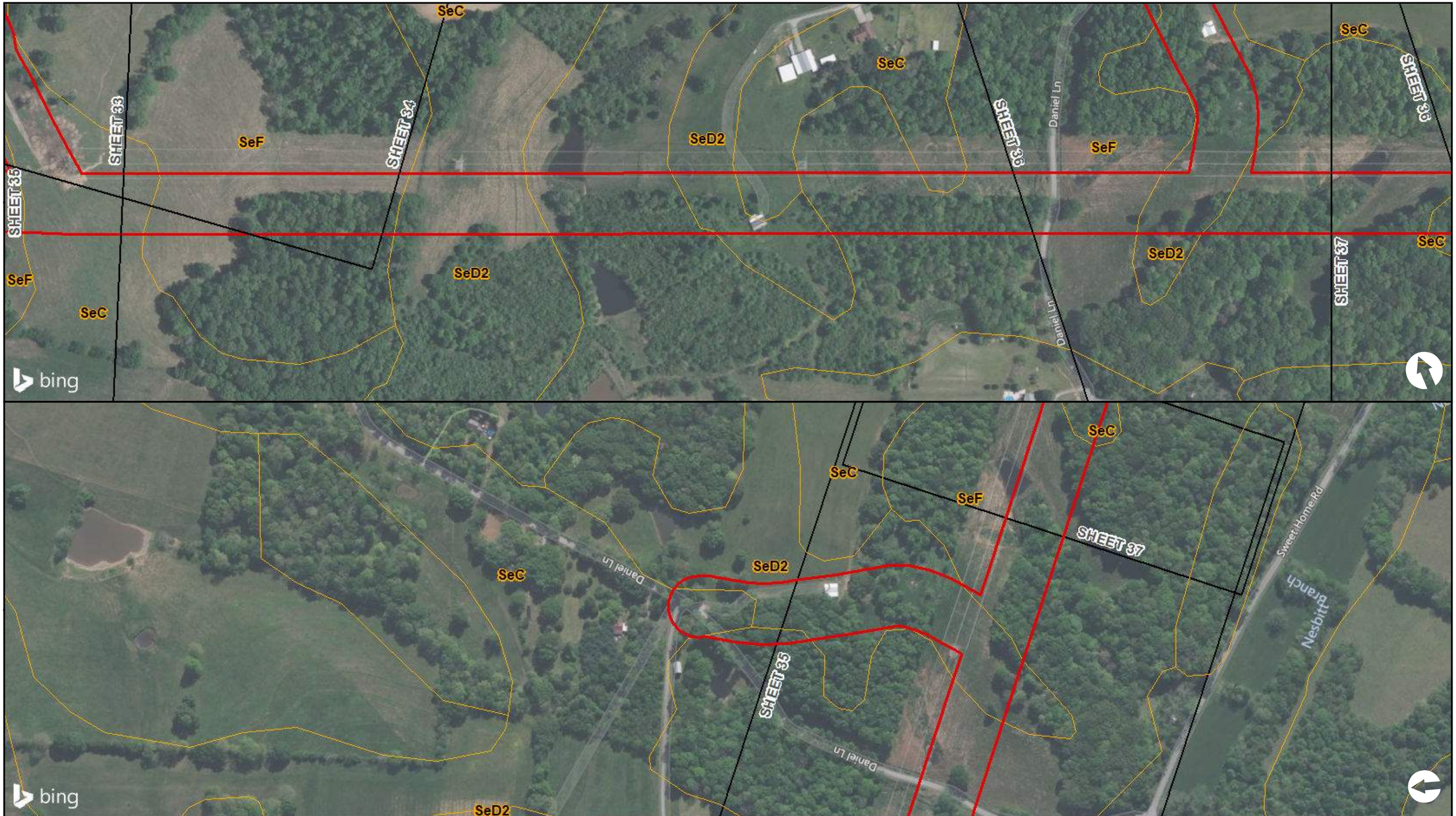


LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery



LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SeC
SeC
SeD2
SHEET 35
SHEET 37
SHEET 36
SeF
SeD2
Harris Cemetery
Old Highway 48
SHEET 39
Ld
SrF
Old Highway 48
ArC
SHEET 38
Sweet Home Rd
Nesbitt Branch
Ira Rd
bing

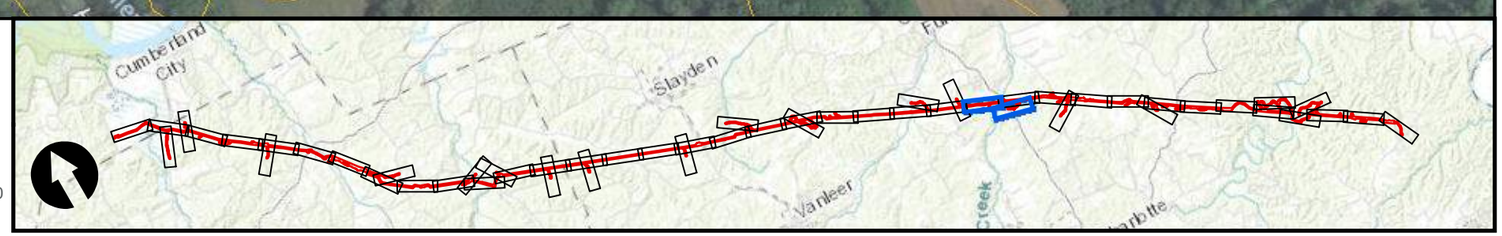
SrF
Ira Rd
SHEET 37
ArC
Bartons Creek
Ld
SeD2
Ira Rd
Ld
Miller Branch
SeF
SHEET 39
SeD2
SeD2
SeF
SeD2
SrF
HuC
bing

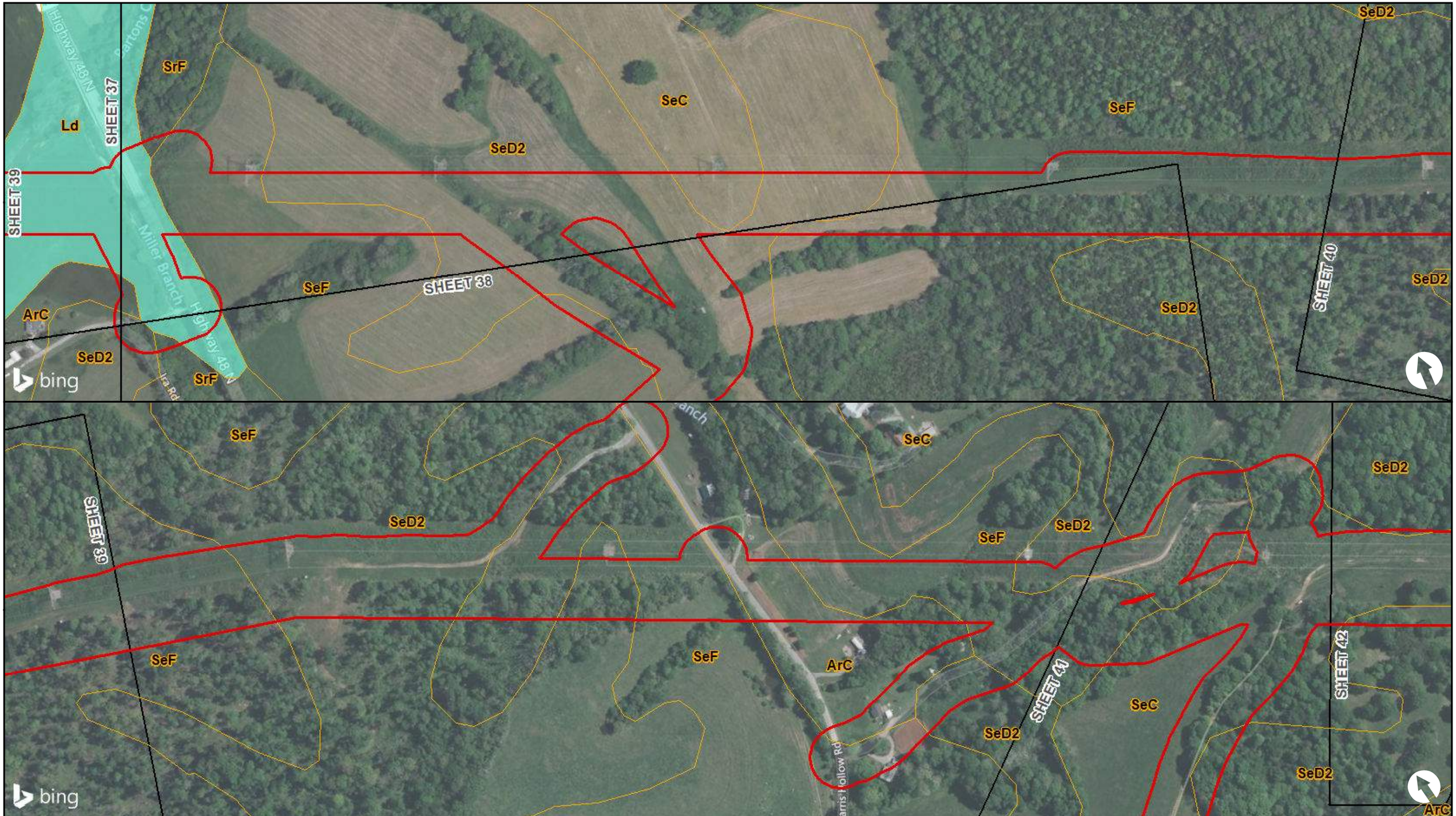
LEGEND

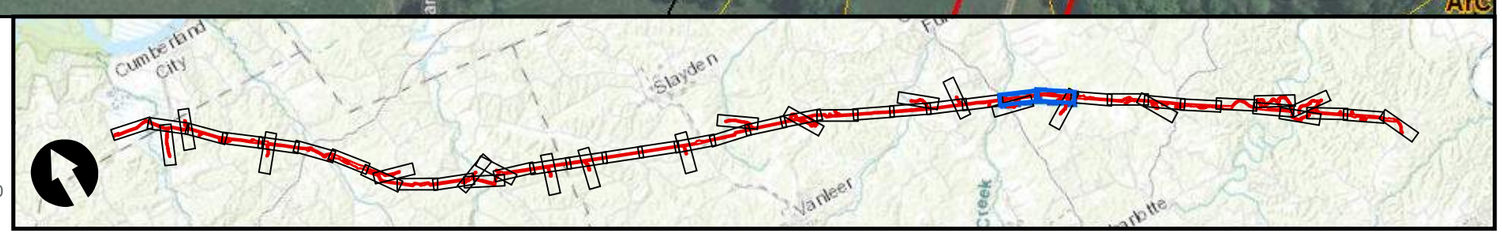
- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery







LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

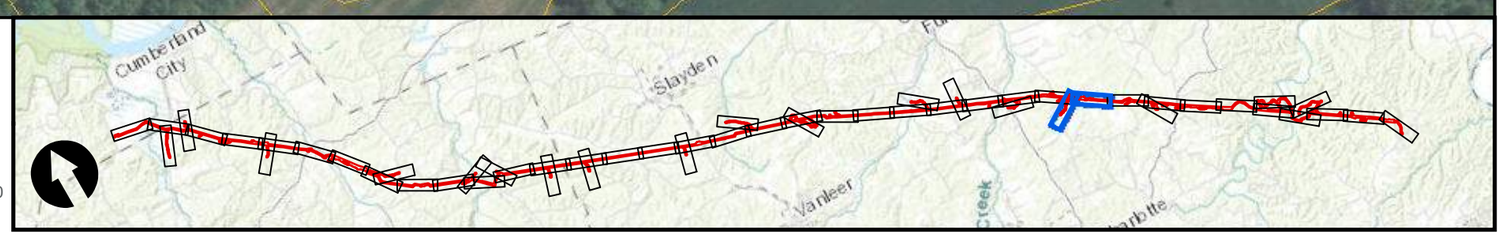
SeF
SeF
SeD2
SeF
SeD2
SeC
SHEET 40
Harris Hollow Rd
SHEET 42
SeD2
SeD2
SeD2
SHEET 40
ArC
Creek
bing

SeD2
SHEET 40
SHEET 41
SeD2
ArC
SeC
SeF
SeD2
Johnson Creek
W
SHEET 43
SeC
SeC
SeD2
SeC
Johnson Creek
SeD2
bing

LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300



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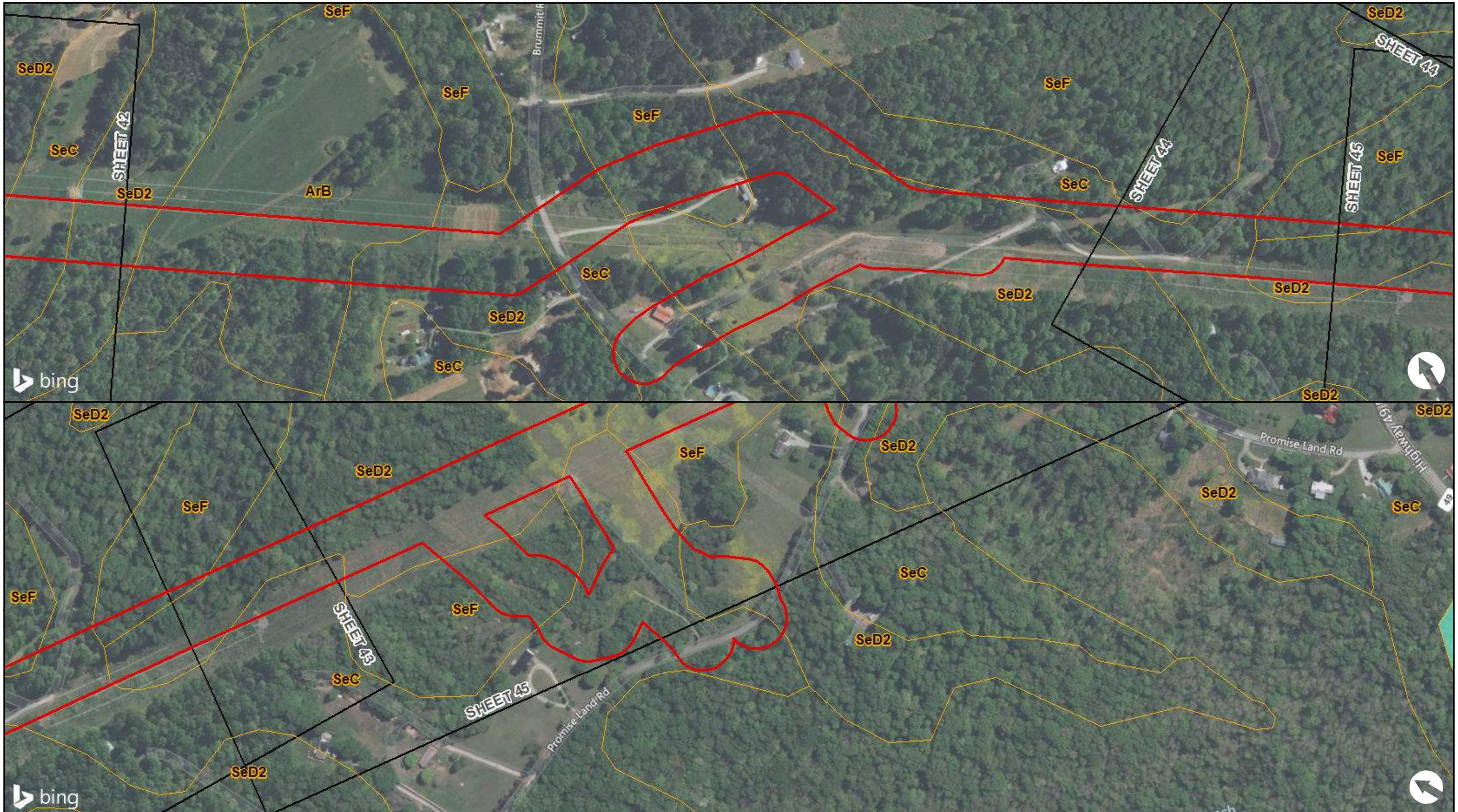
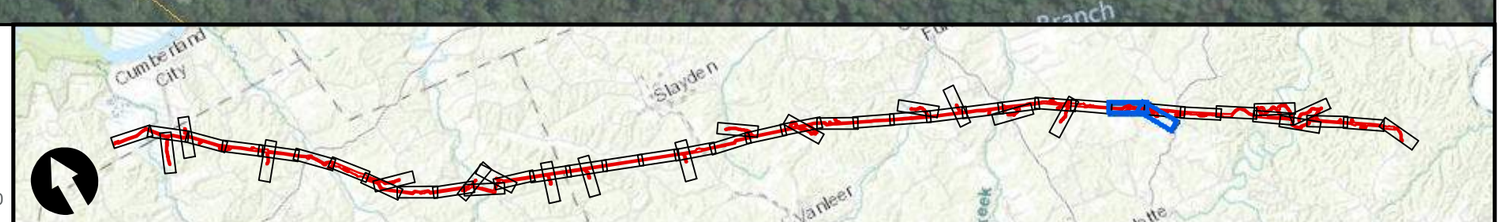




LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SeC
SeF
SeD2
SeF
SeD2
SeC
SeF
SeD2
SHEET 45
SHEET 43
SHEET 44
Promise Land Rd
SeF
SeD2
SeC
SeD2
Highway 49E
49
SeD2
SeF
SHEET 46
bing

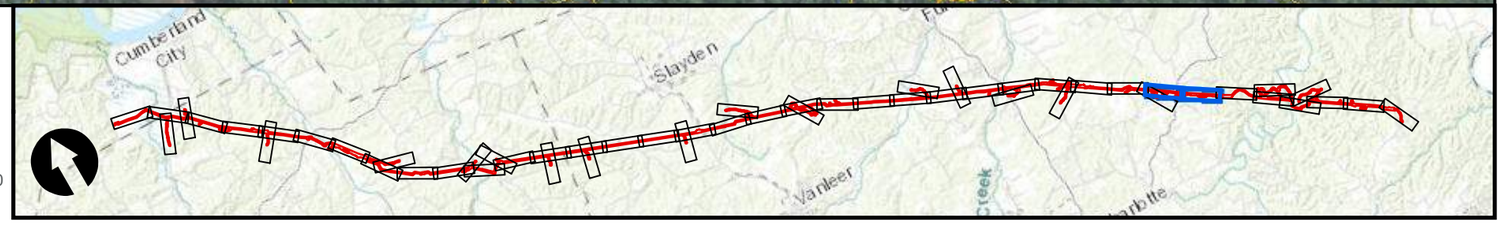
SeF
HsF
HsF
HsF
SeD2
SeC
SHEET 47
HaD
HsF
SeC
SeC
SeF
SeF
HsF
HsF
HsF
HsF
SHEET 48
bing

LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery



SeC
HgC
HgC
SHEET 46
HaD
HsF
White Oak Flat
HgC
SHEET 48
SHEET 49
HsF
SeC
HsF
bing

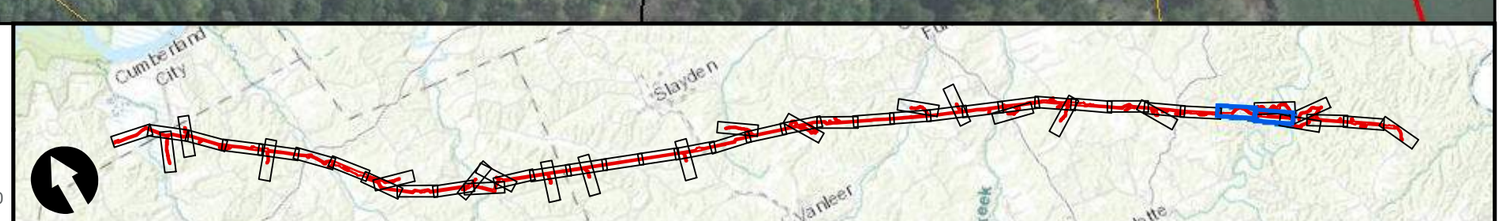
Ld
Rc
SHEET 51
ByB2
Su
SHEET 49
SHEET 50
HgC
SHEET 47
MnC
Jones Creek
HsF
No
HgC
bing
HgC

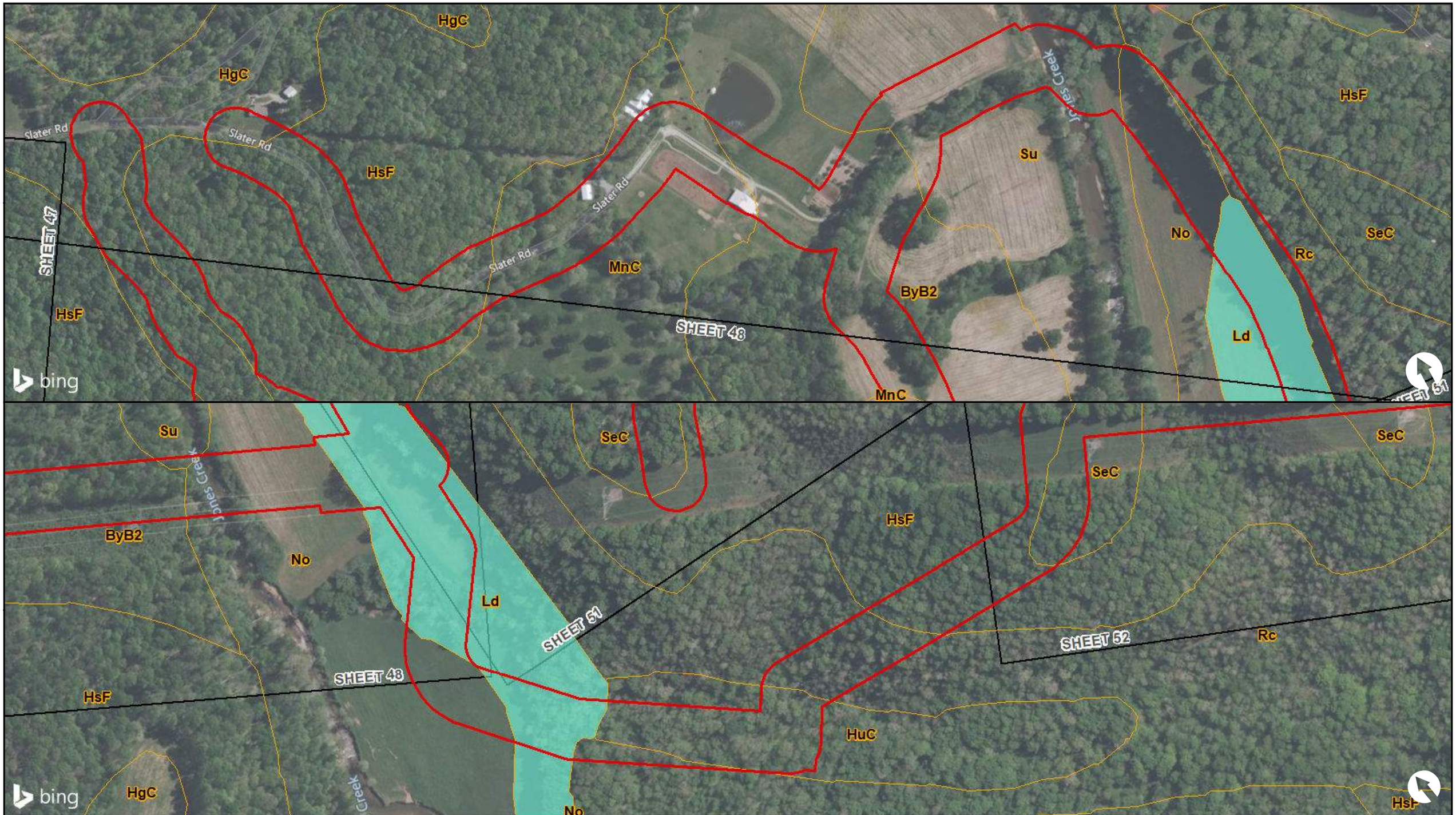
LEGEND

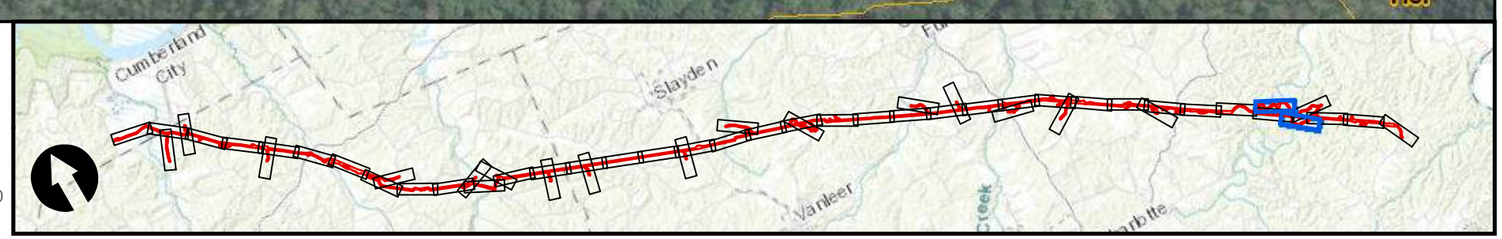
- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery







LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

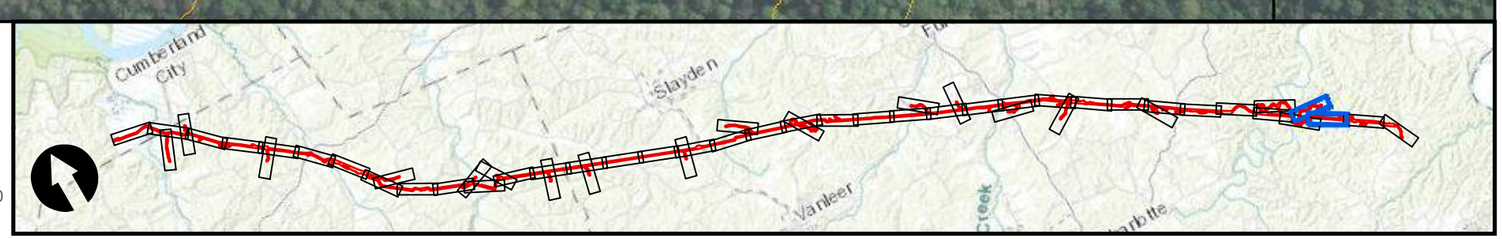
SHEET 49
SHEET 48
SHEET 50
SHEET 52
Rc
Ld
HsF
SeC
HsF
HsF
HsF
HsF
Nosegay Rd
bing

SHEET 51
SHEET 50
SHEET 53
SeC
HsF
SeC
SeC
Rc
HsF
Nosegay Rd
bing

LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300



DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

0 Feet 300

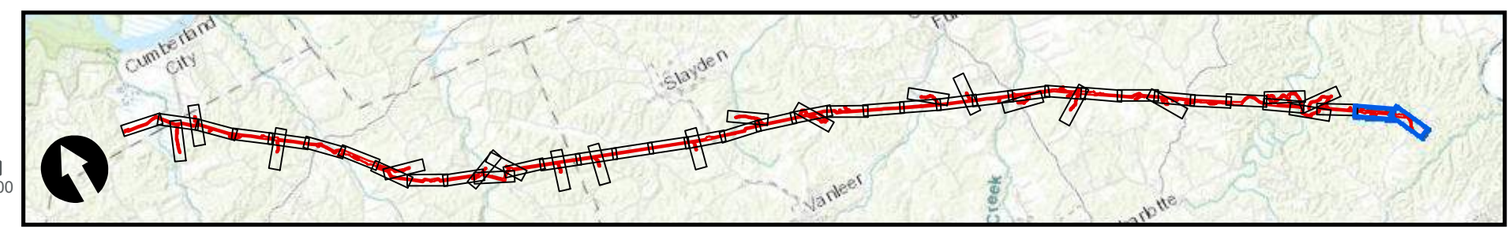
DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

LEGEND

- Alt A Pipeline Corridor
- Soil Map Unit
- Hydric Rating (1-32%)
- Hydric Rating (100%)

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

0 Feet 300



Appendix D – Alternative A Pipeline Farmland Map

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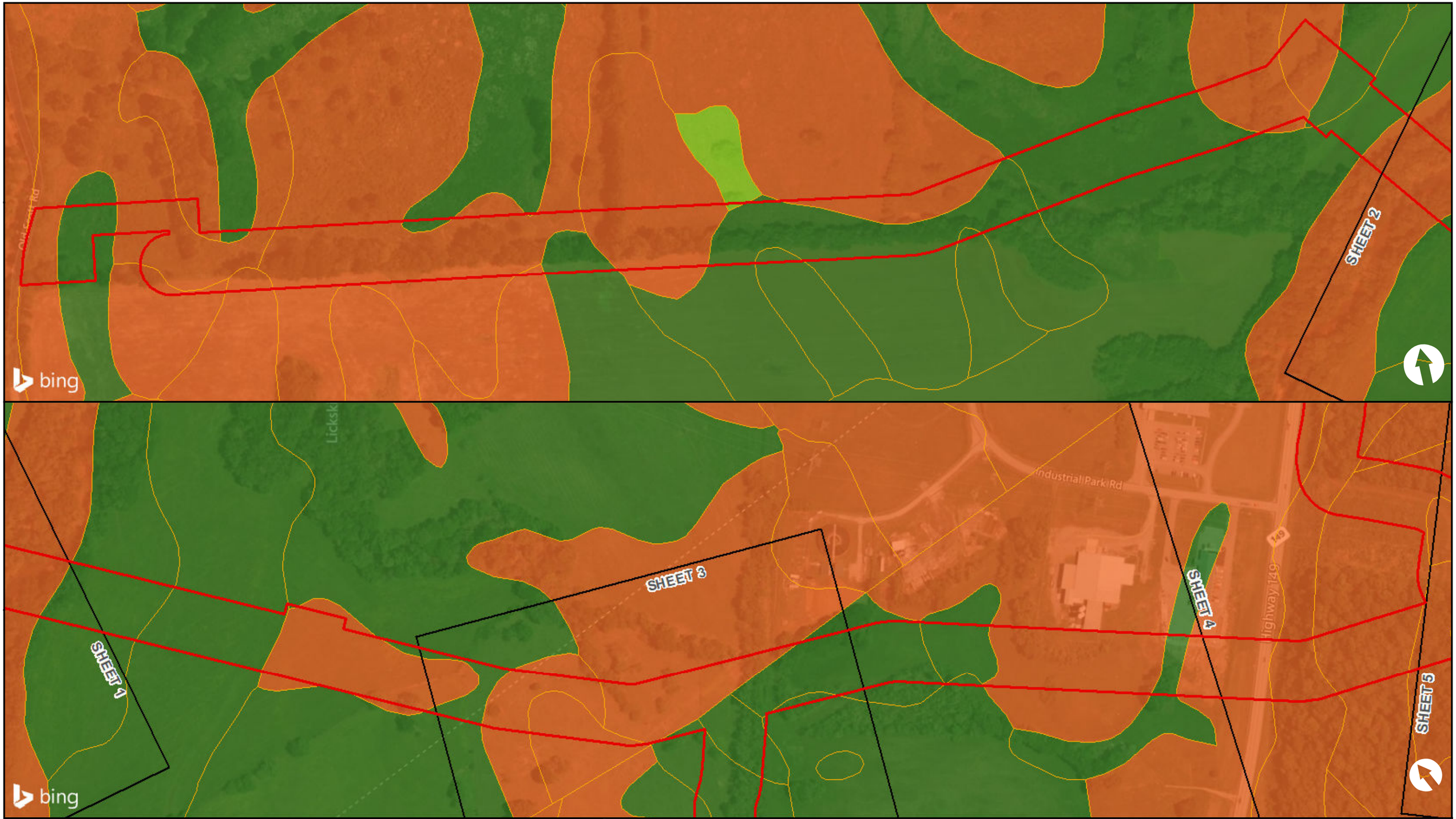
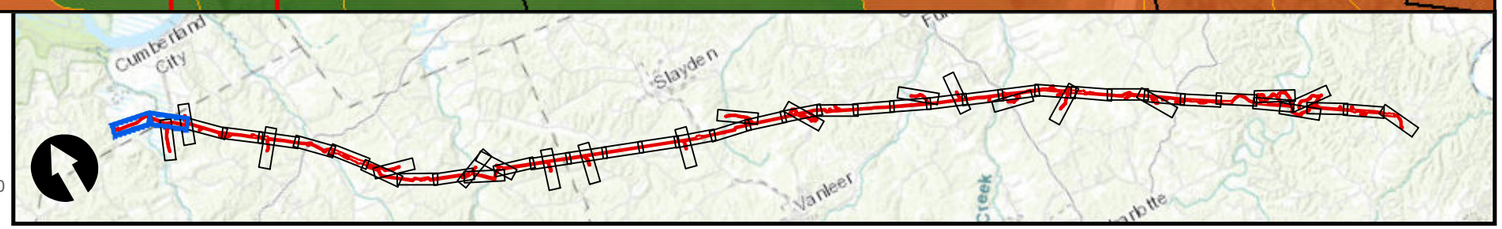


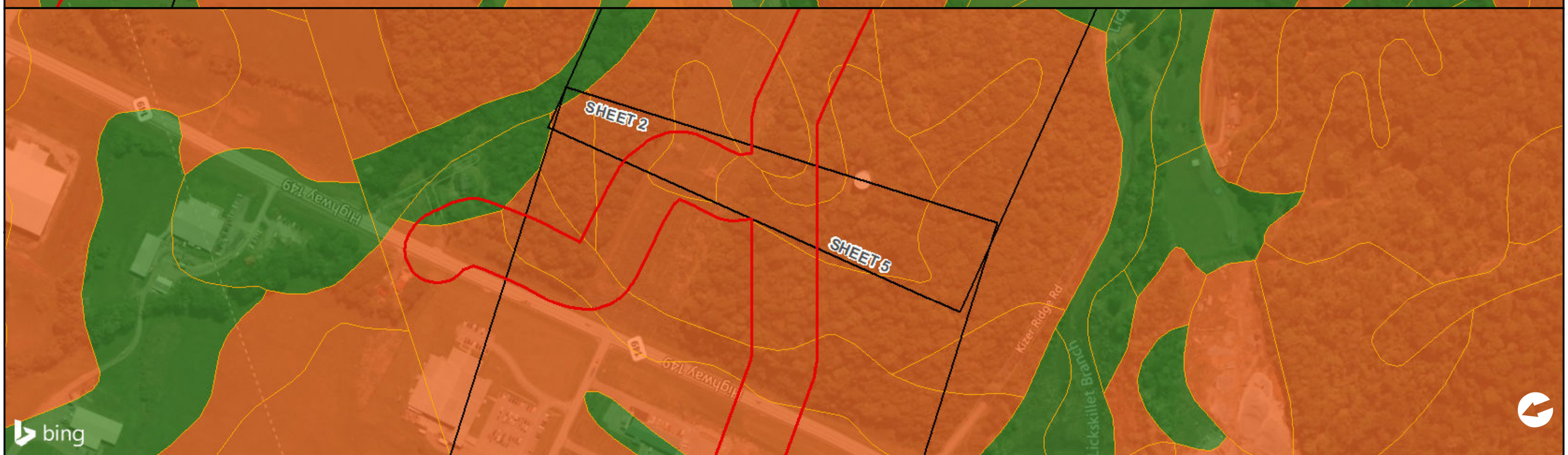
LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
- Prime farmland if drained
- Farmland of local importance
- Not prime farmland



0 Feet 300

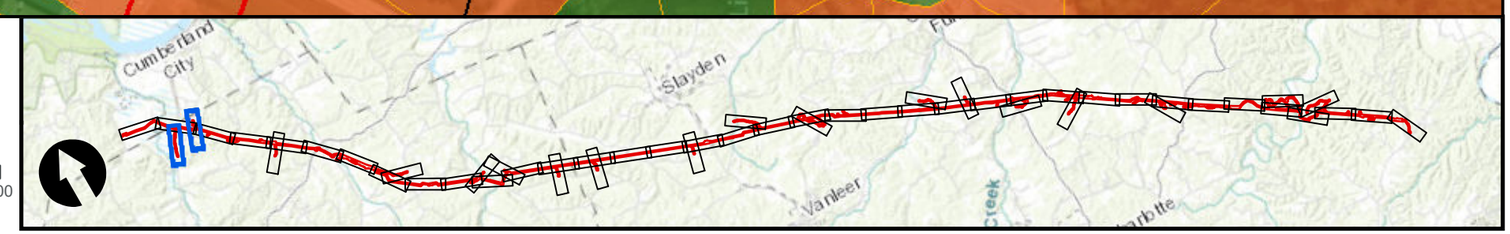
DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery



LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
- Prime farmland if drained
- Farmland of local importance
- Not prime farmland

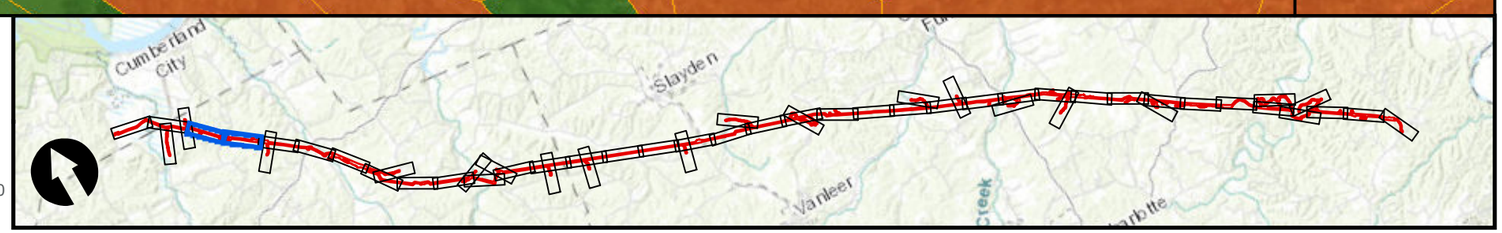
0 Feet 300



DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 2
SHEET 4
SHEET 6
Kizer Ridge Rd
Lickskillet Branch
Branch Rd

SHEET 5
SHEET 8
Pulley Hollow Ln
Lickskillet Branch



LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
- Prime farmland if drained
- Farmland of local importance
- Not prime farmland

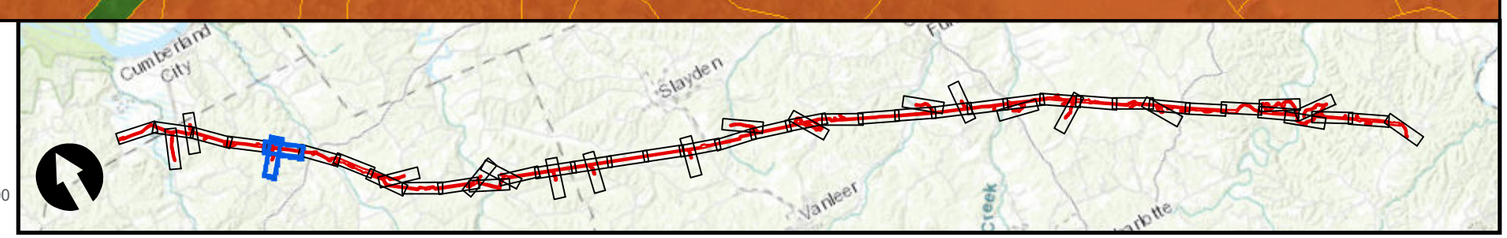
0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
- Prime farmland if drained
- Farmland of local importance
- Not prime farmland

0 Feet 300



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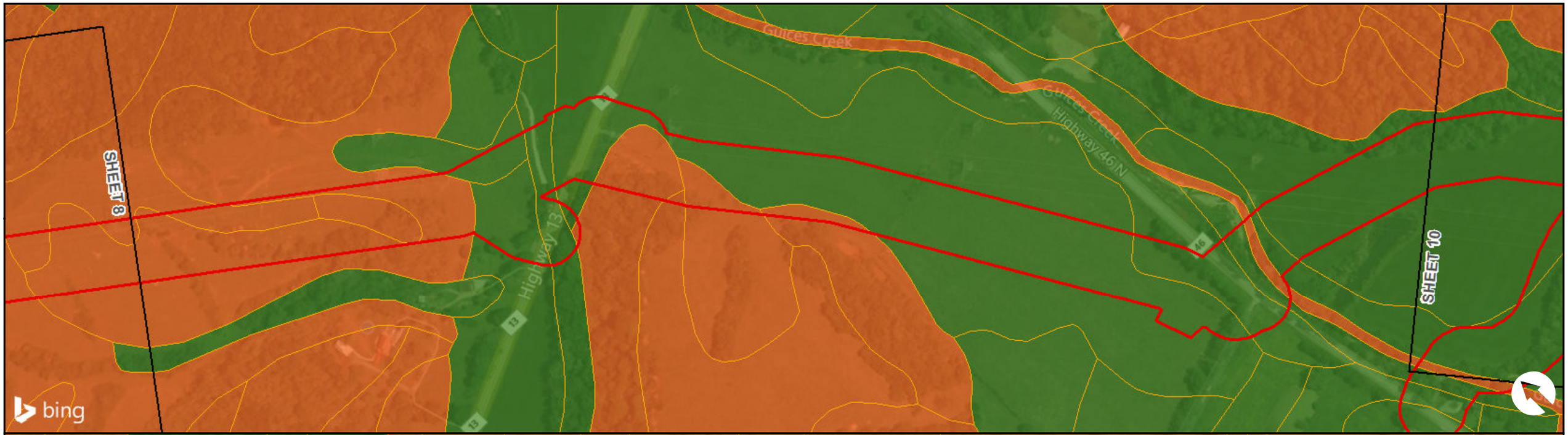
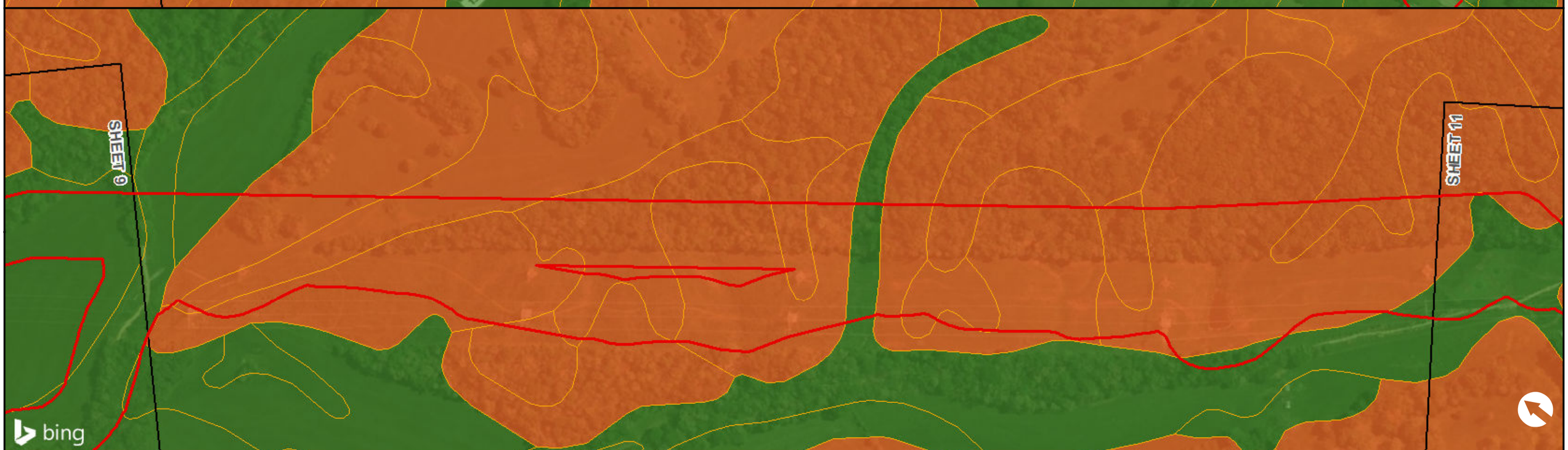


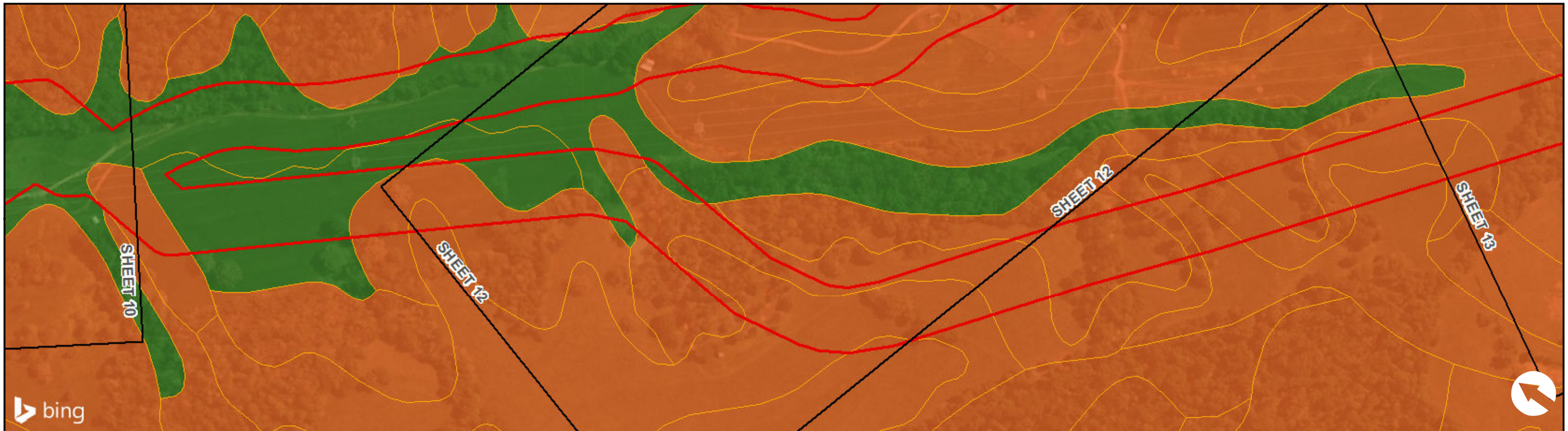


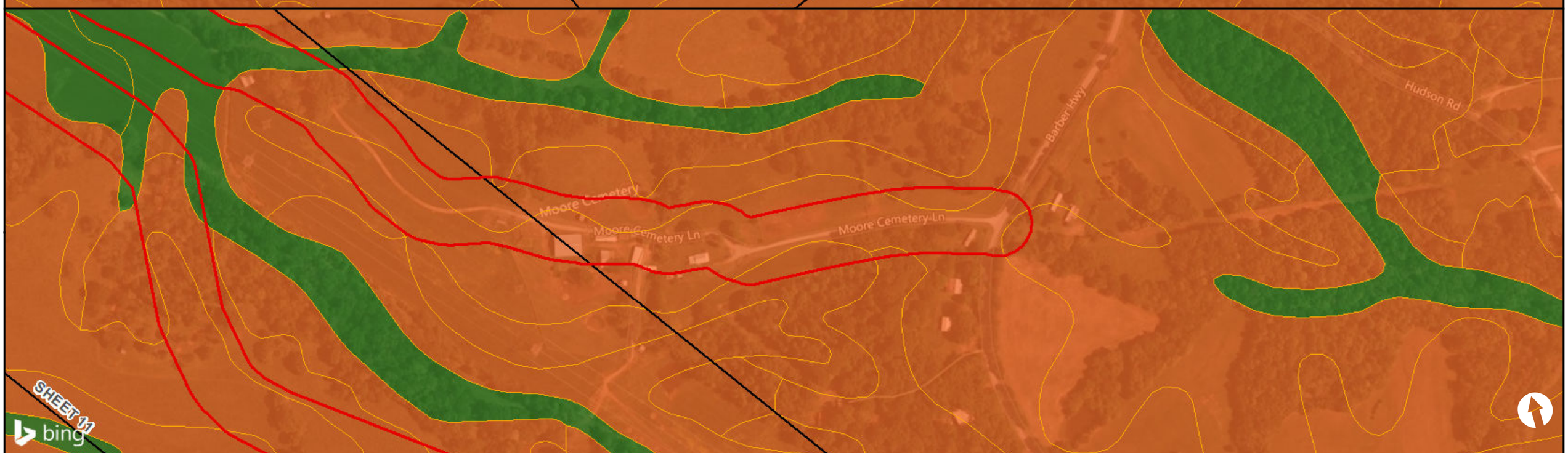
LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
- Prime farmland if drained
- Farmland of local importance
- Not prime farmland

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

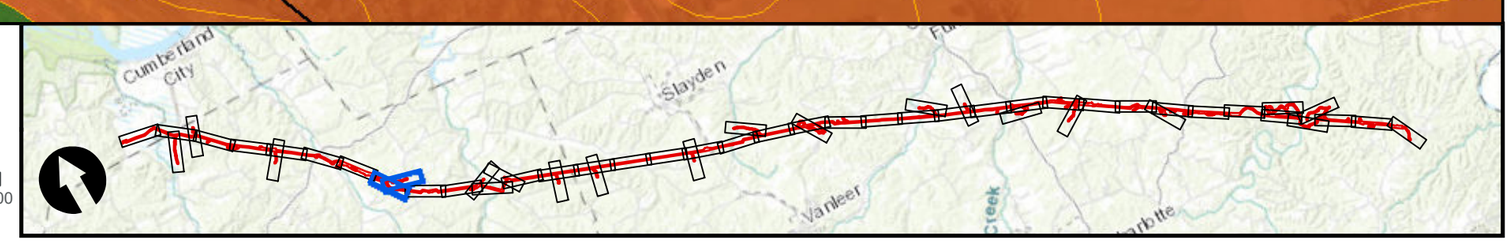




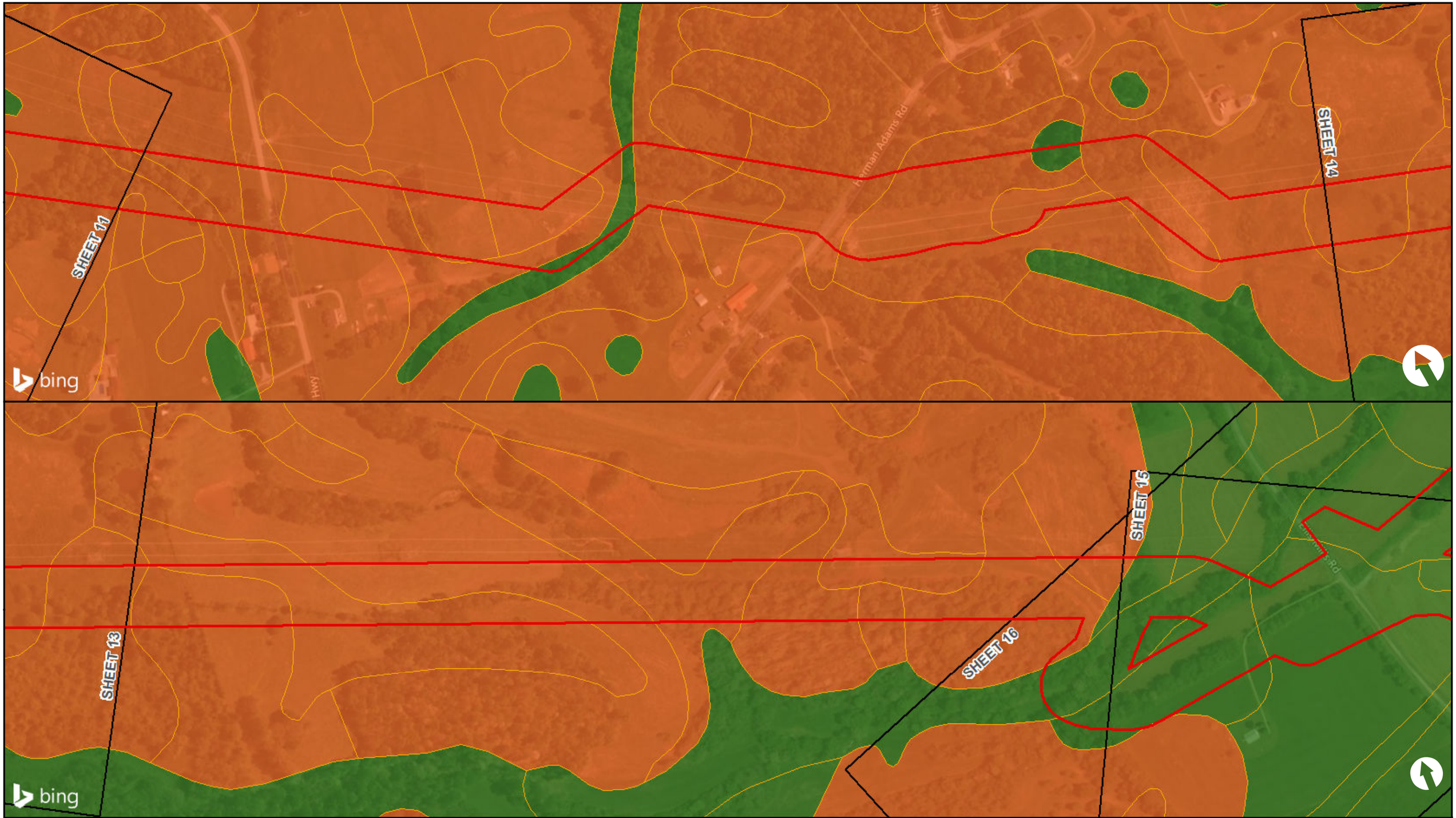
LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
- Prime farmland if drained
- Farmland of local importance
- Not prime farmland

0 Feet 300



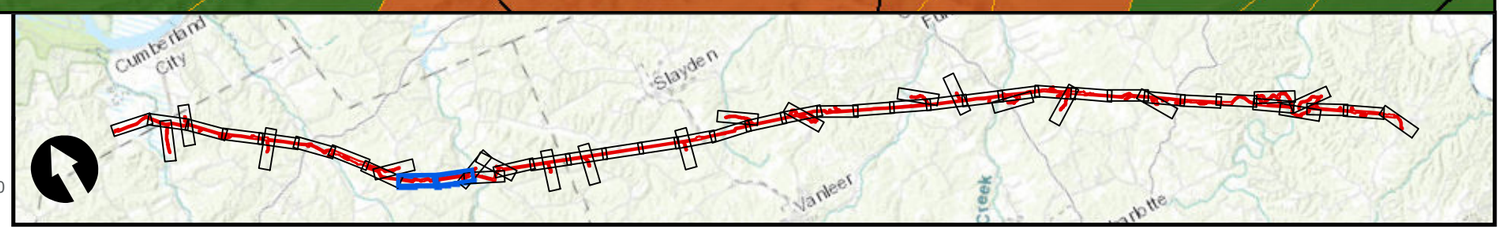
DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery



LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
- Prime farmland if drained
- Farmland of local importance
- Not prime farmland

0 Feet 300



DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 15

SHEET 16

SHEET 14

SHEET 18

Hayes Rd

Williamson Branch Rd

Ellis Mills Rd

bing

SHEET 17

SHEET 15

SHEET 14

Yellow Creek

bing

LEGEND

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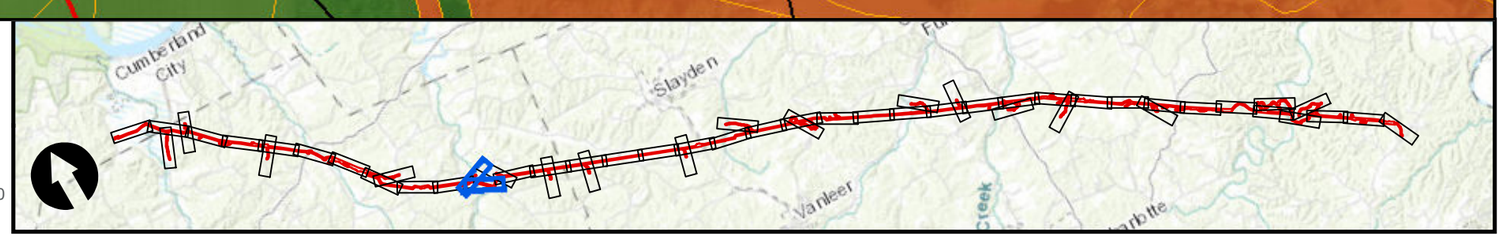
- Not prime farmland

0 Feet 300



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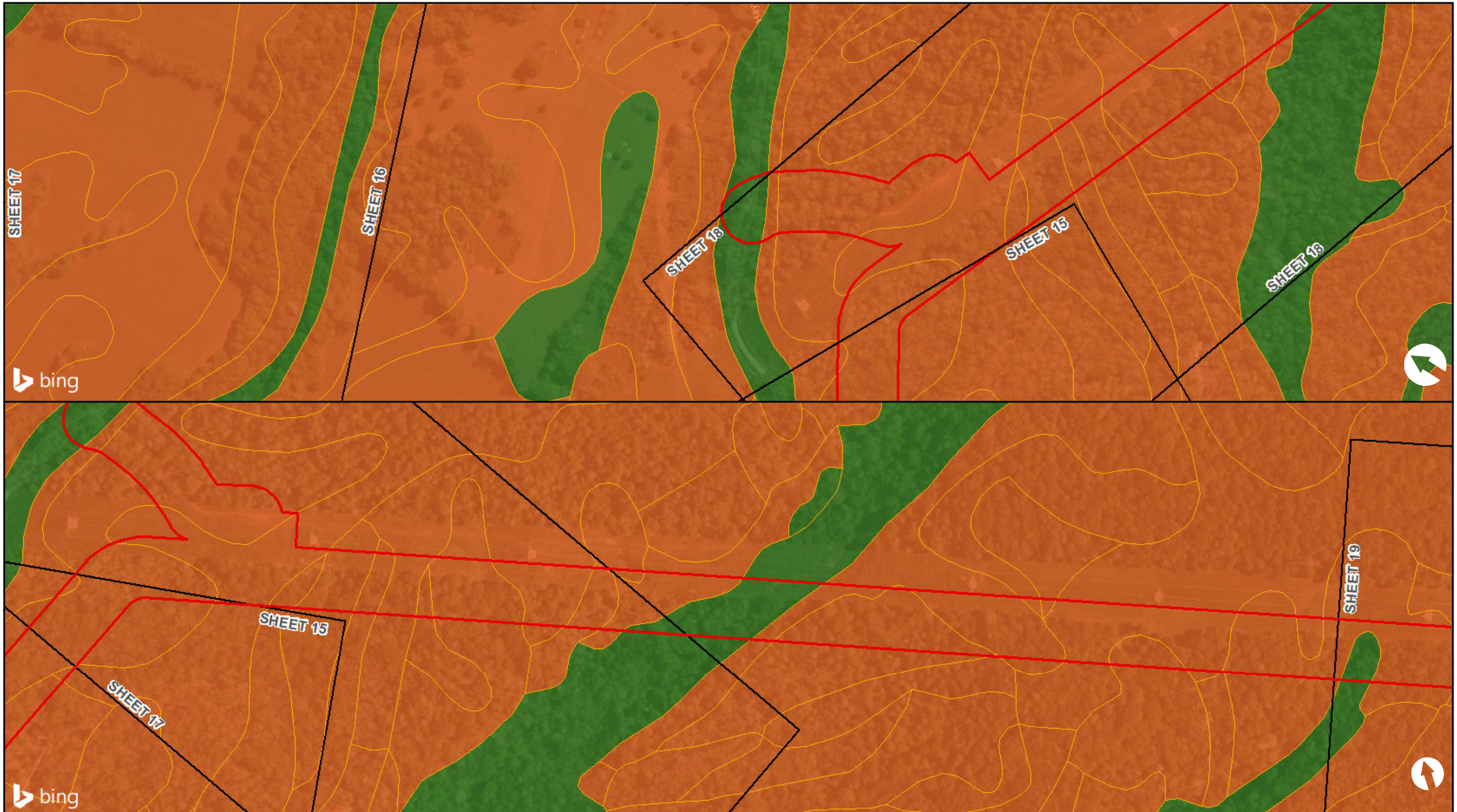

LEGEND

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0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 18

SHEET 20

SHEET 20

SHEET 21

SHEET 19

Norris Hollow Rd

bing

bing

LEGEND

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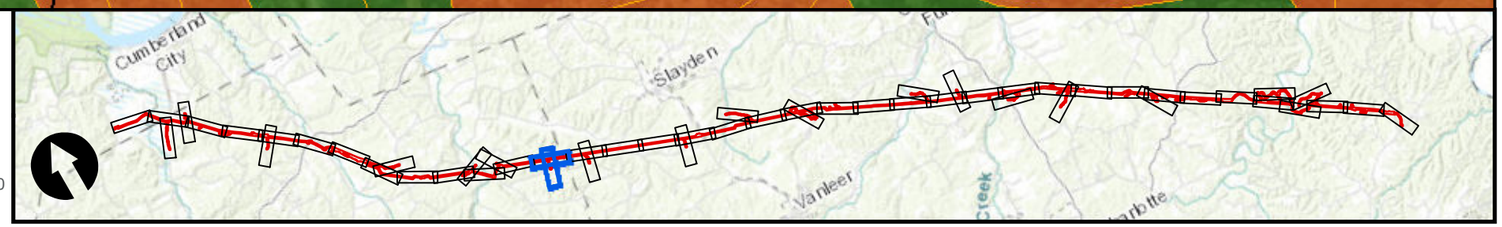
0 Feet 300



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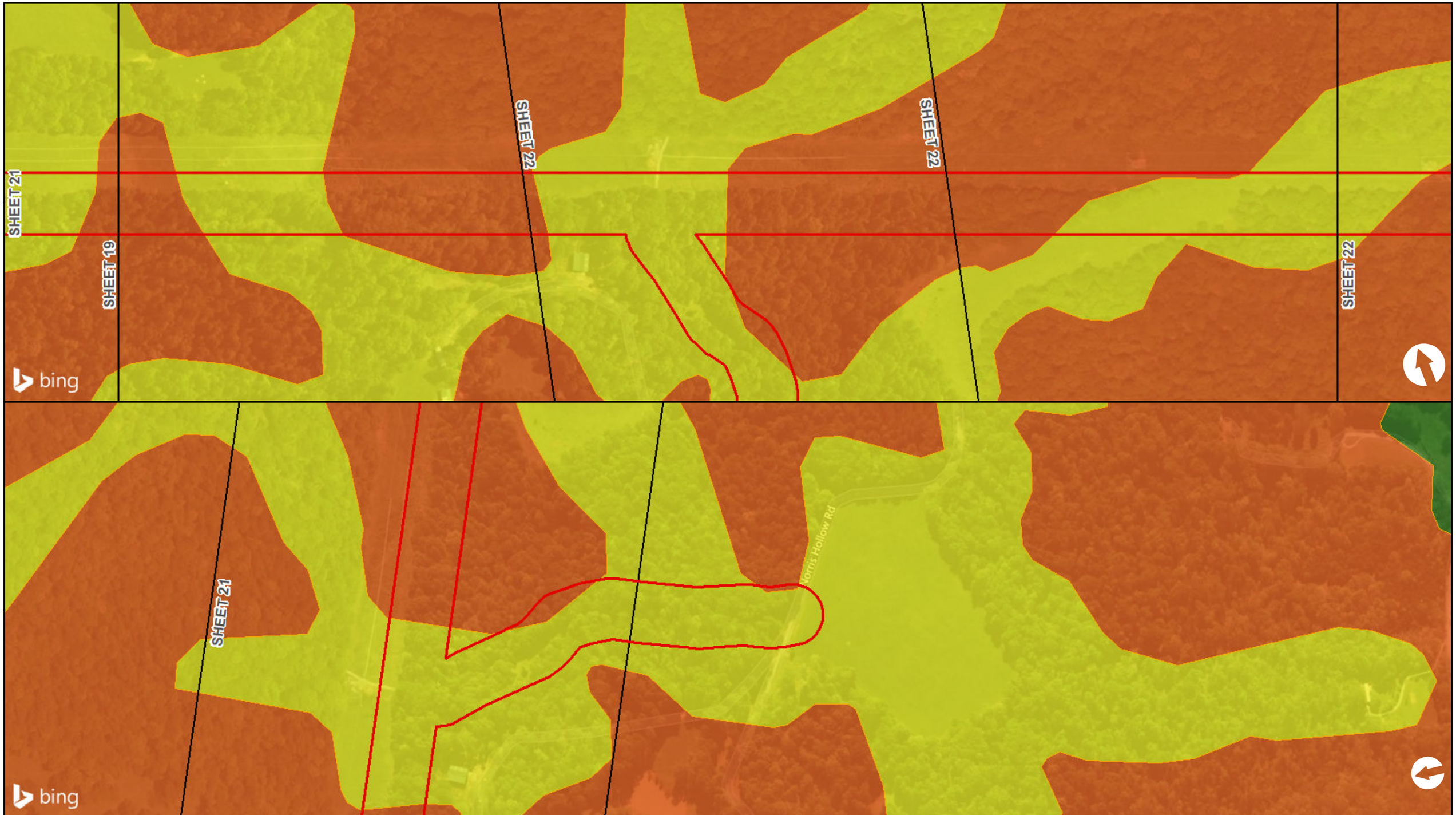

LEGEND

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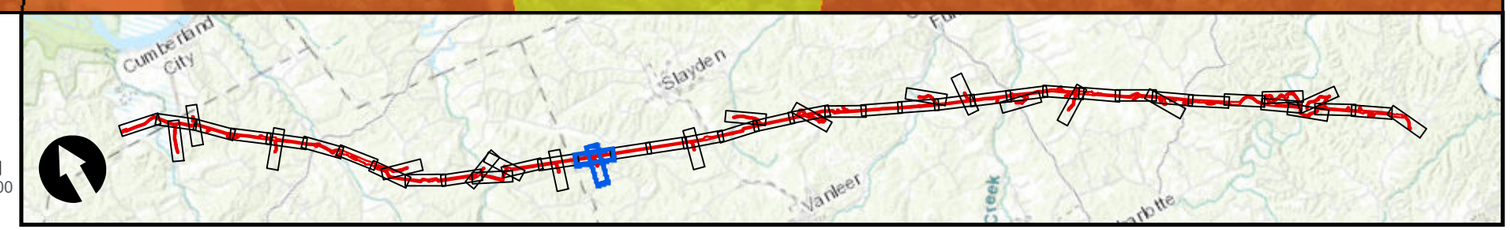
0 Feet 300



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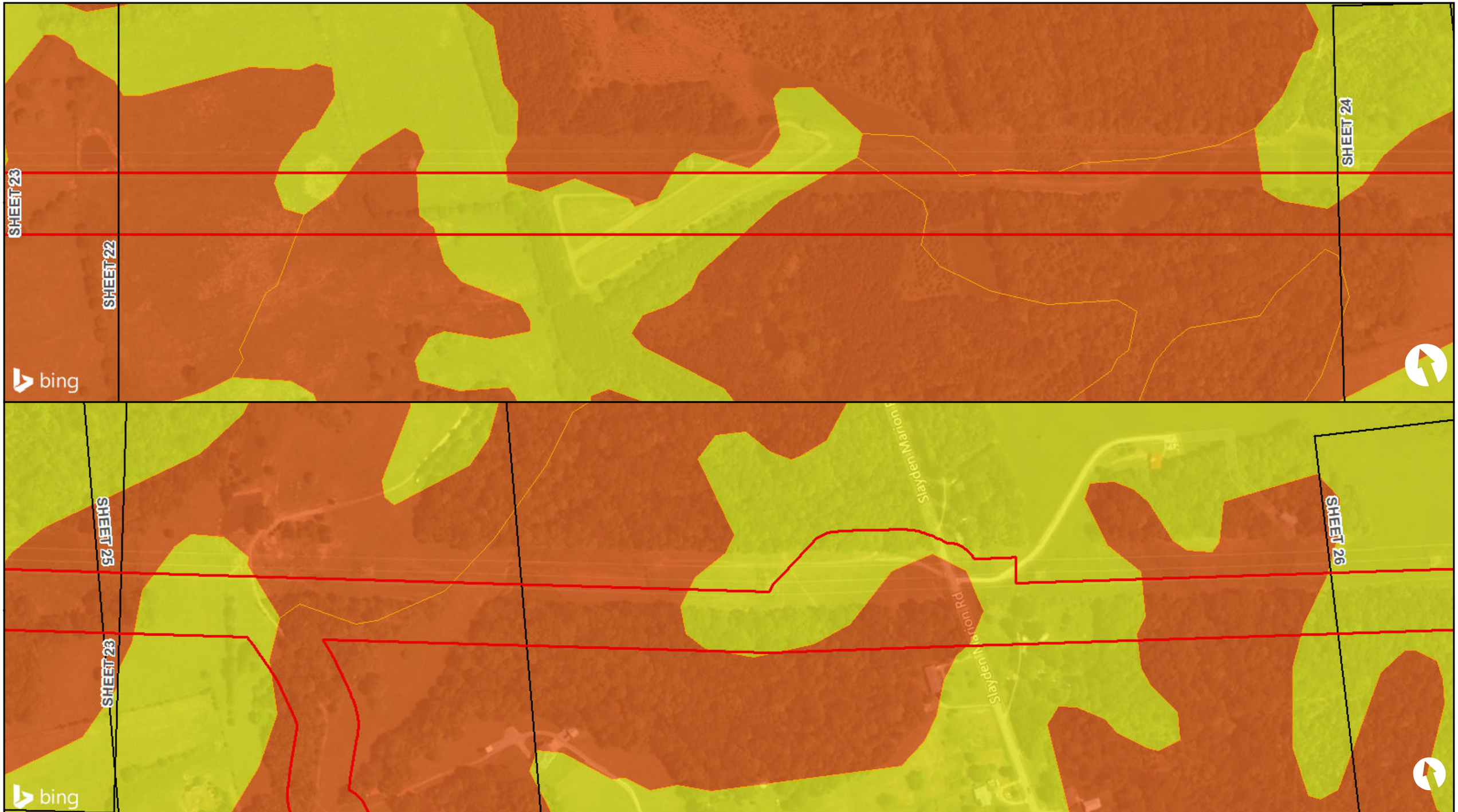

LEGEND

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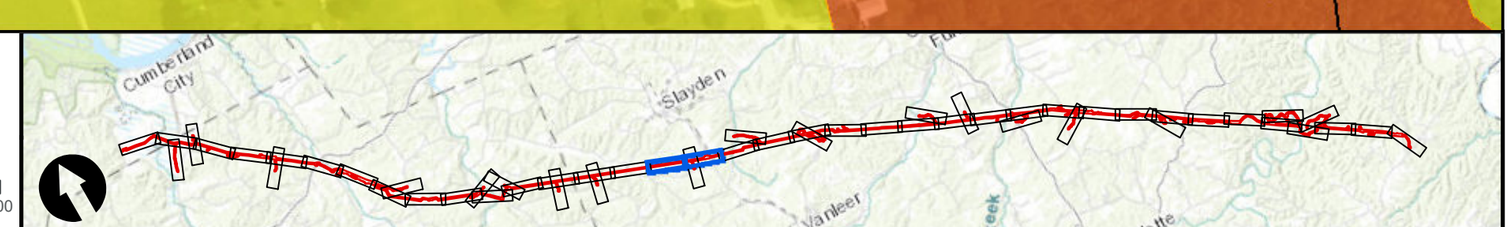
0 Feet 300



DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 24

SHEET 24

SHEET 23

bing

SHEET 24

Little Barton Creek

Little Barton Creek Rd

SHEET 28

bing

LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
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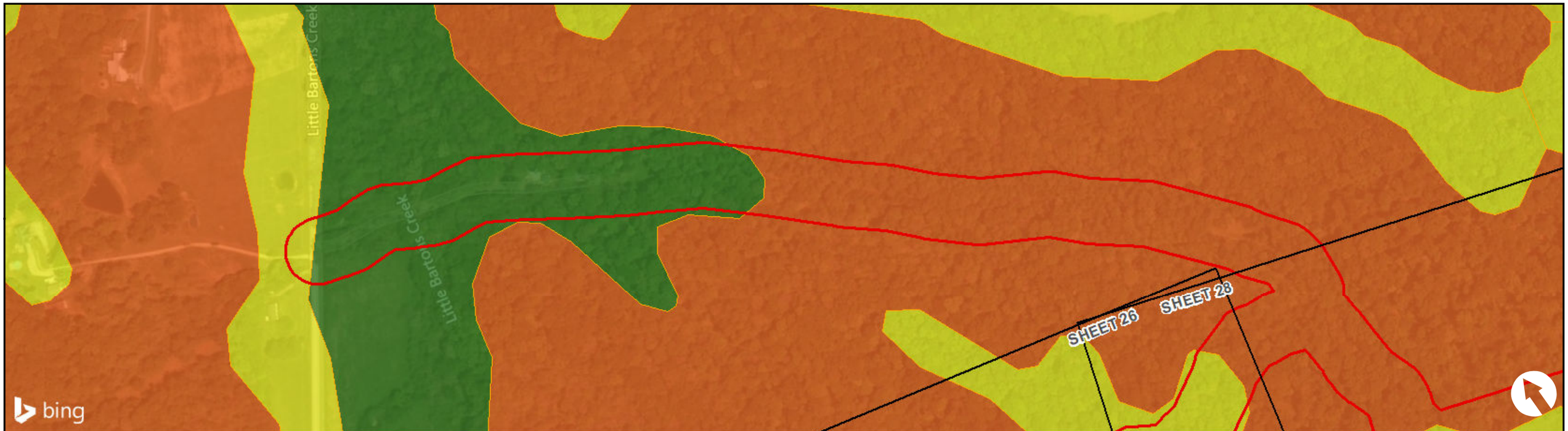
- Farmland of local importance
- Not prime farmland

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

0 Feet 300



LEGEND

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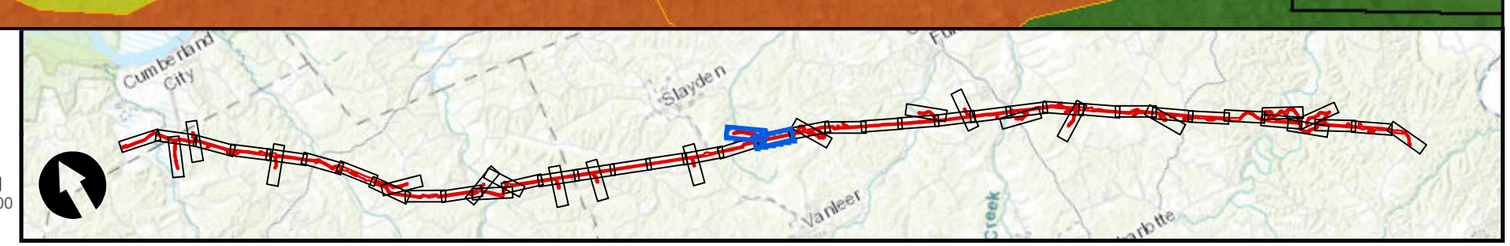

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 28

SHEET 30

SHEET 30

SHEET 31

Butcher Ridge Rd

bing

SHEET 29

Butcher Ridge

New Dry Hollow Rd

Dry Hollow Branch

bing

ET 28

LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
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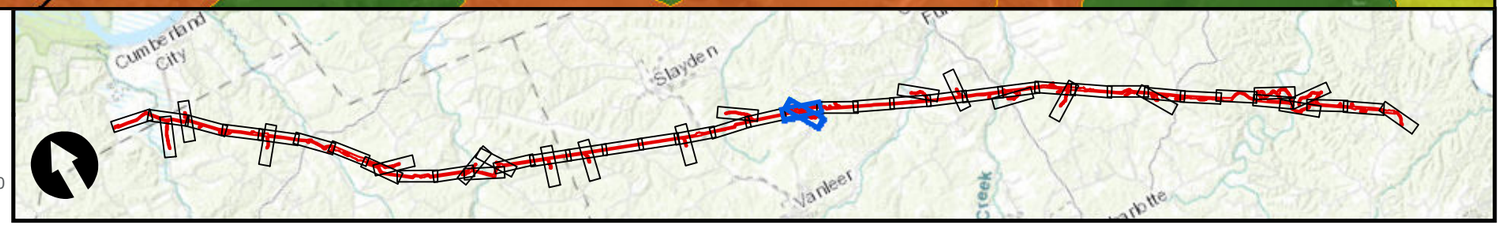
0 Feet 300



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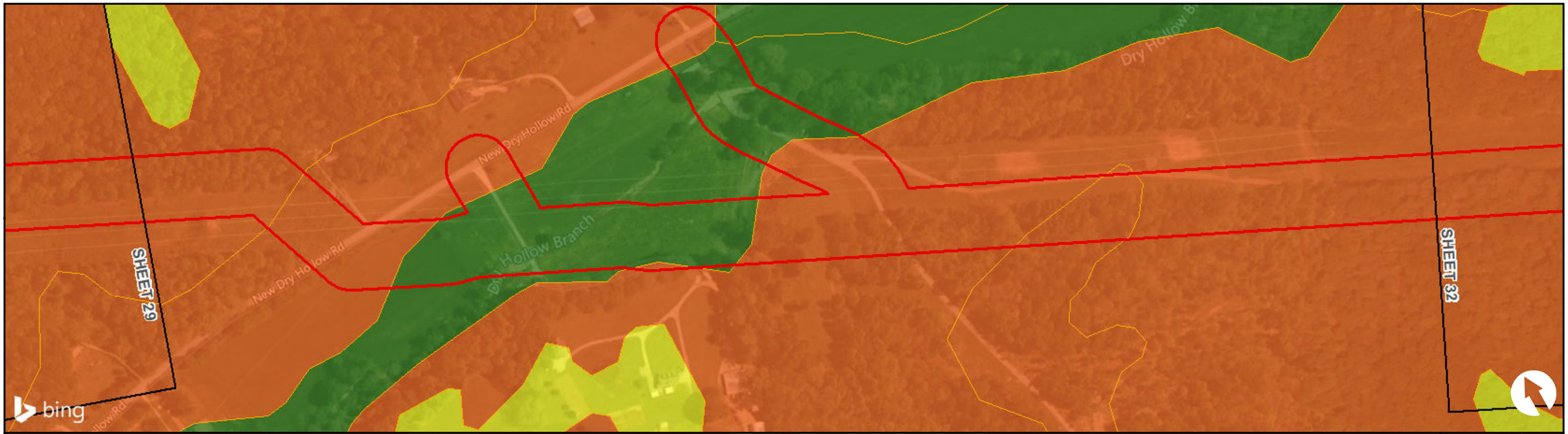

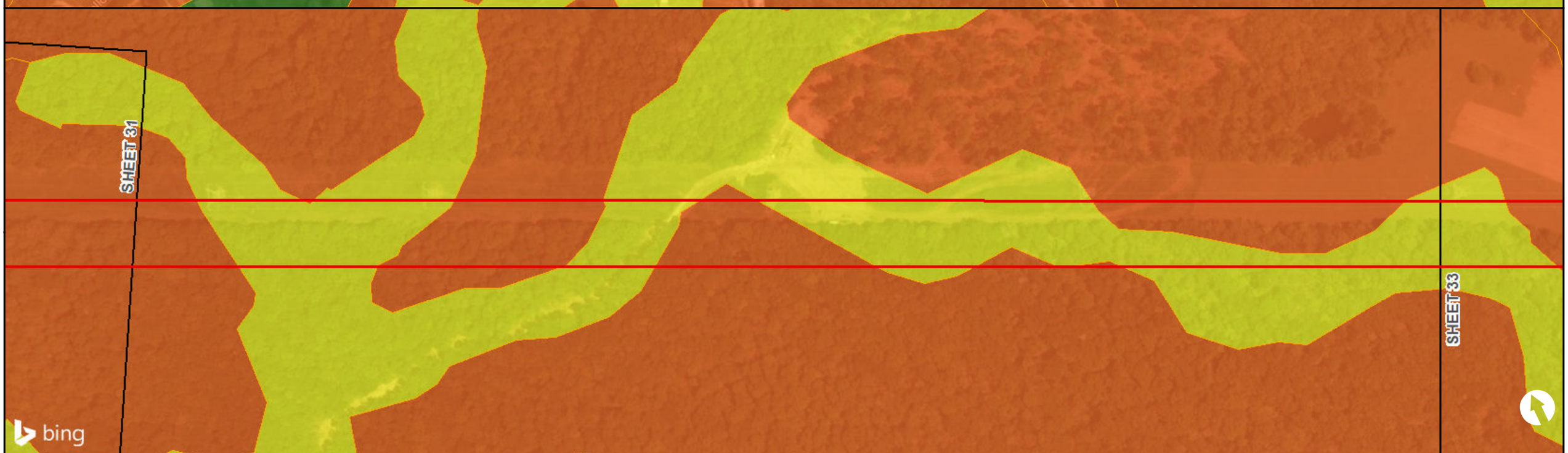

LEGEND

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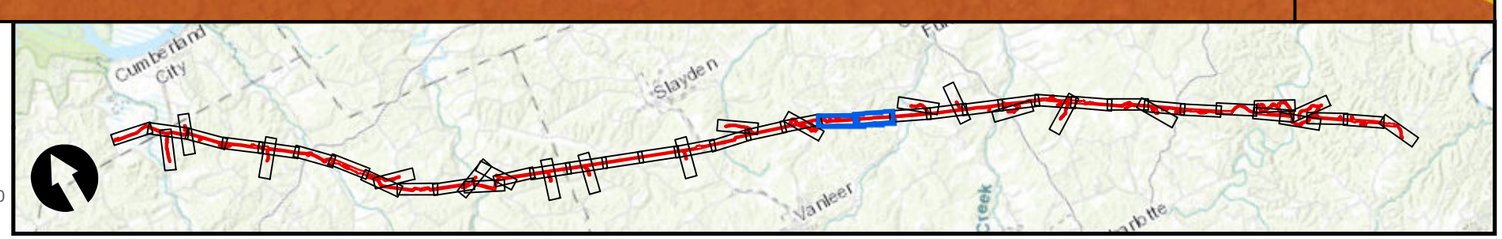
0 Feet 300



DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 33

SHEET 32

SHEET 35

Furnace Creek

Bell Hollow Rd

Sweet Home Rd

bing

SHEET 35

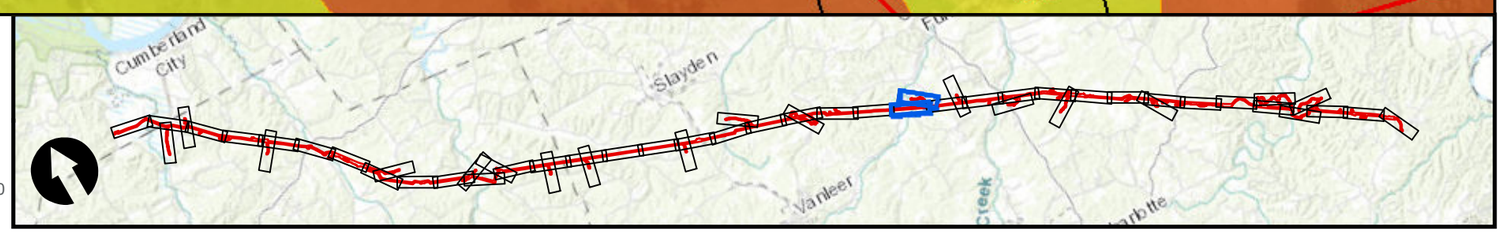
SHEET 33

Furnace Creek

Bell Hollow Rd

Sweet Home Rd

bing



LEGEND

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- Not prime farmland

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 35

SHEET 33

SHEET 34

SHEET 36

SHEET 36

SHEET 37

bing

SHEET 37

SHEET 35

Daniel Ln

Sweet Home Rd

Nesbitt Branch

bing

LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
- Prime farmland if drained
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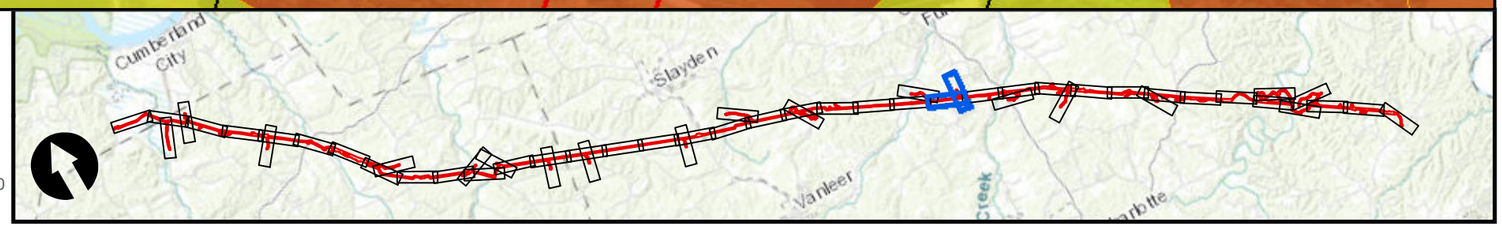
0 Feet 300



DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 35

SHEET 36

SHEET 37

SHEET 38

SHEET 39

Harris Cemetery

Nesbitt Branch

Old Highway 48

Sweet Home Rd

Ira Rd

Bartons Creek

Miller Branch

bing

LEGEND

- Alt A Pipeline Corridor
- All areas are prime farmland
- Prime farmland if drained
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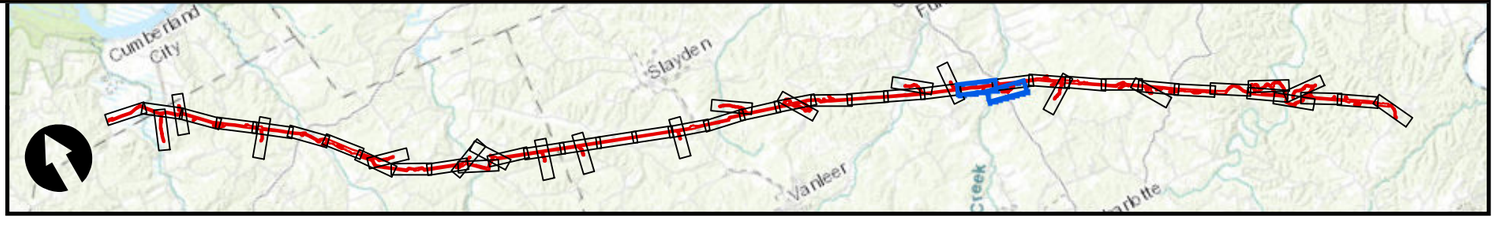
- Not prime farmland

0 Feet 300



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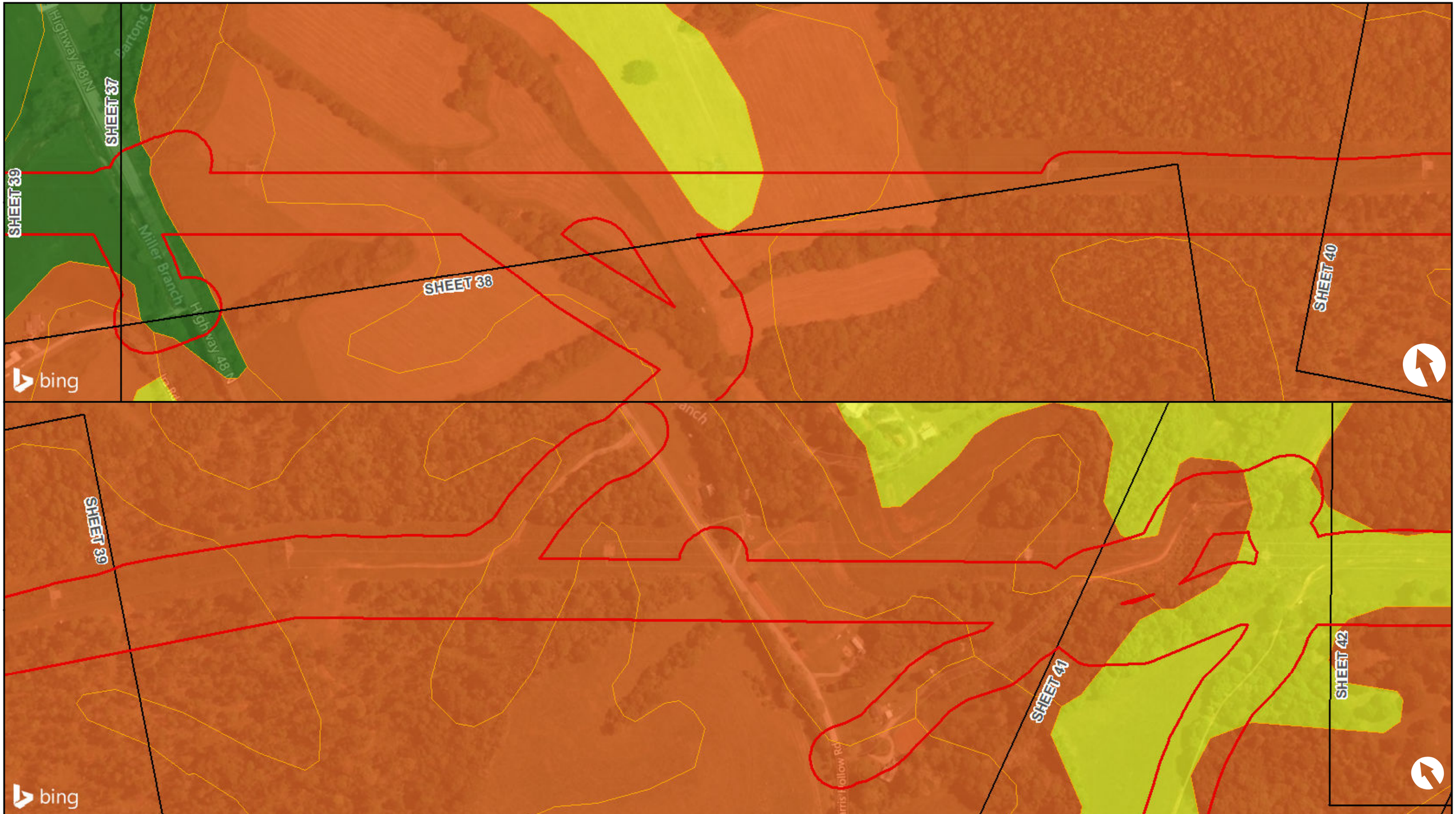

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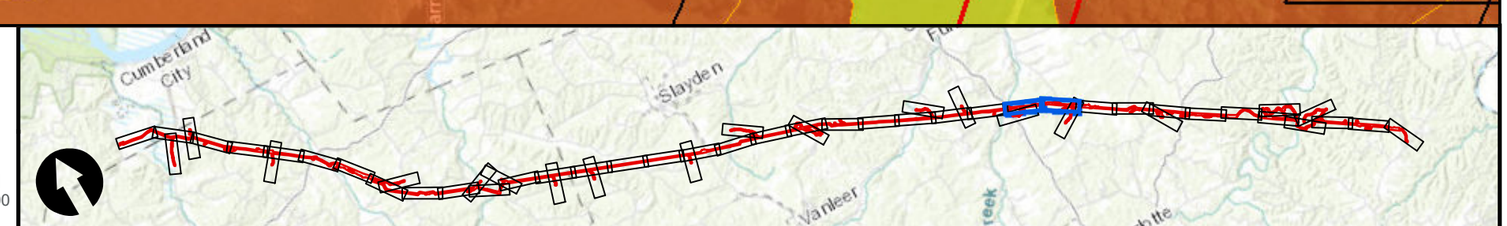
0 Feet 300



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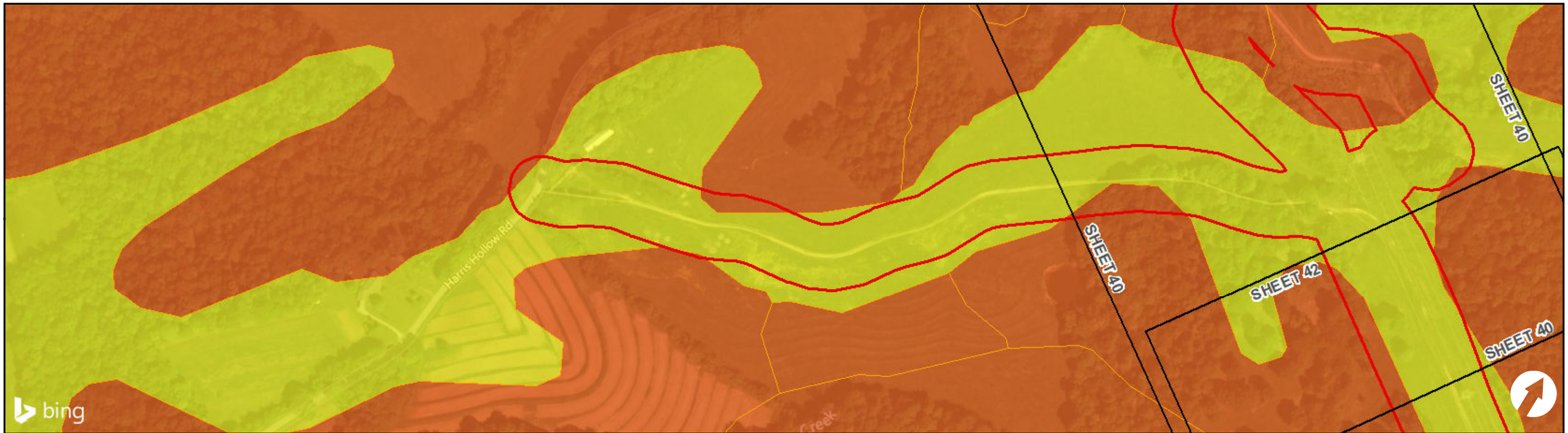

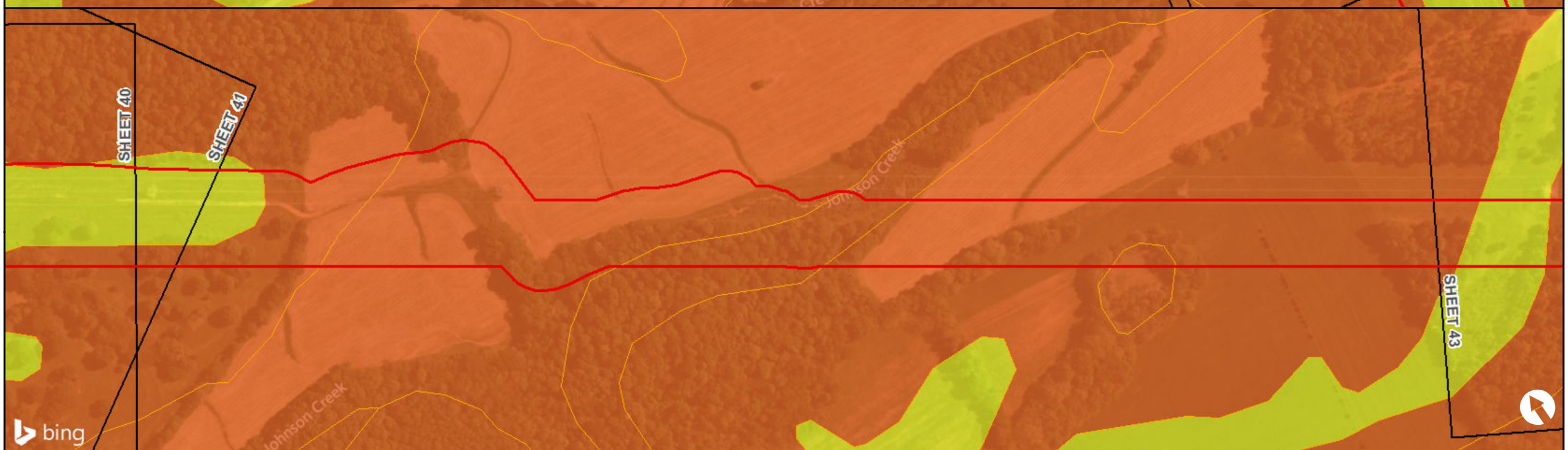

LEGEND

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- Not prime farmland

0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 42

SHEET 44

SHEET 44

SHEET 45

bing

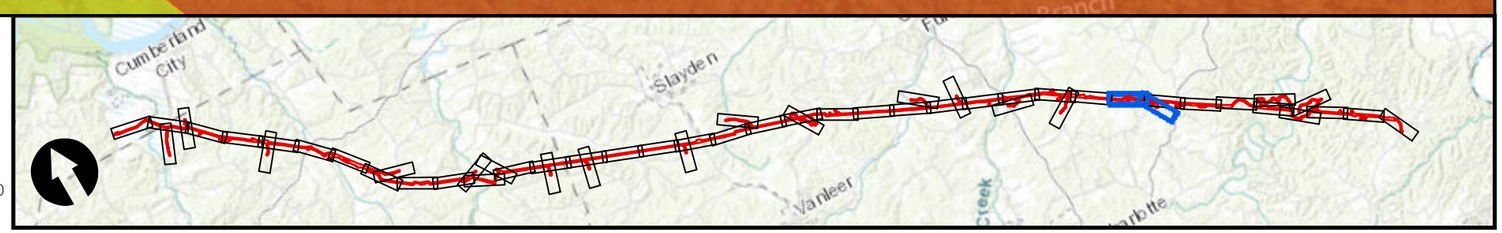
SHEET 43

SHEET 45

Promise Land Rd

Promise Land Rd

bing



LEGEND

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0 Feet 300

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 45

SHEET 43

SHEET 44

Promise Land Rd

Highway 49 E

SHEET 46

SHEET 47

SHEET 43

LEGEND

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- All areas are prime farmland
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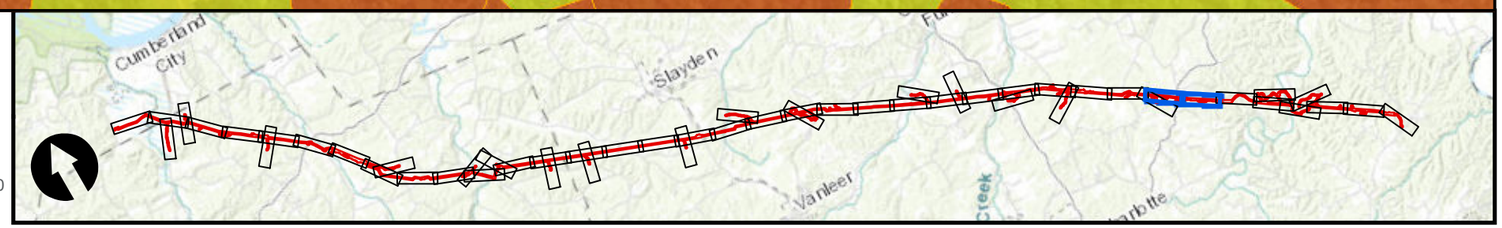
- Not prime farmland

0 Feet 300



DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

SHEET 46

SHEET 48

SHEET 49

White Oak Flatt Rd

bing

SHEET 47

SHEET 49

SHEET 50

SHEET 51

bing

LEGEND

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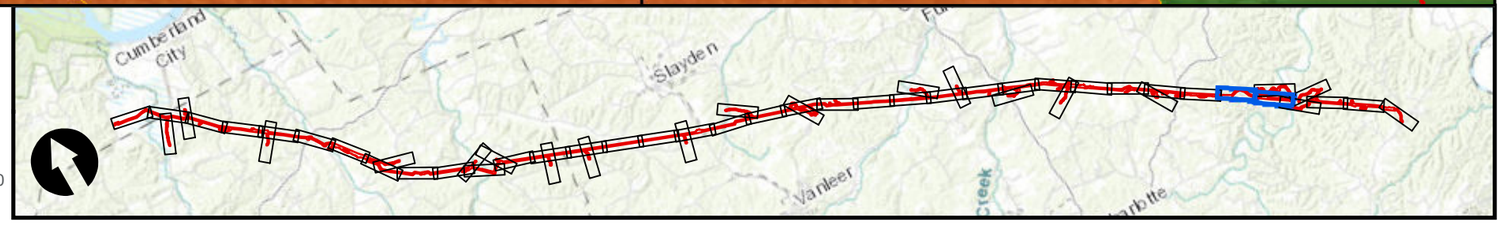
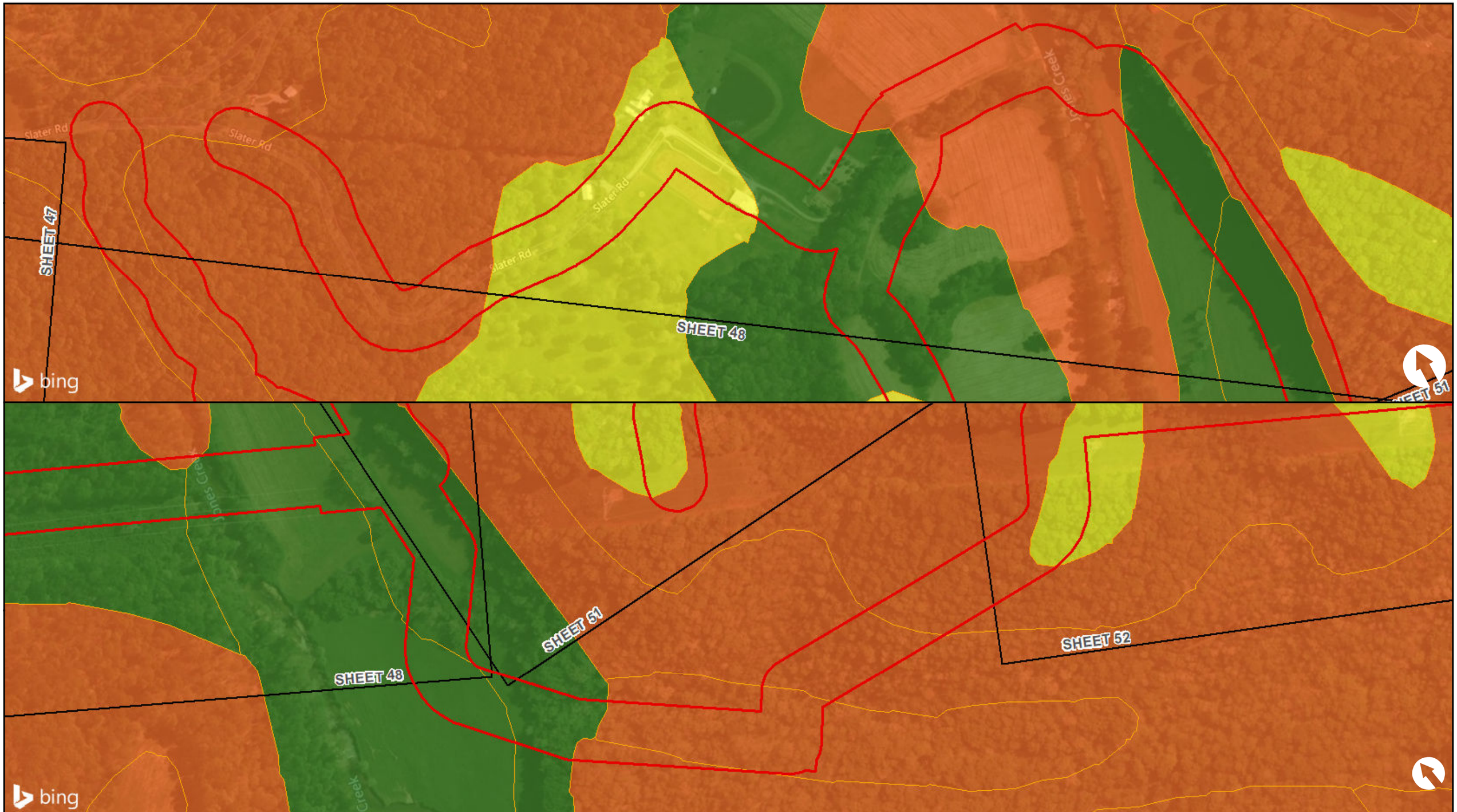
0 Feet 300



DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery



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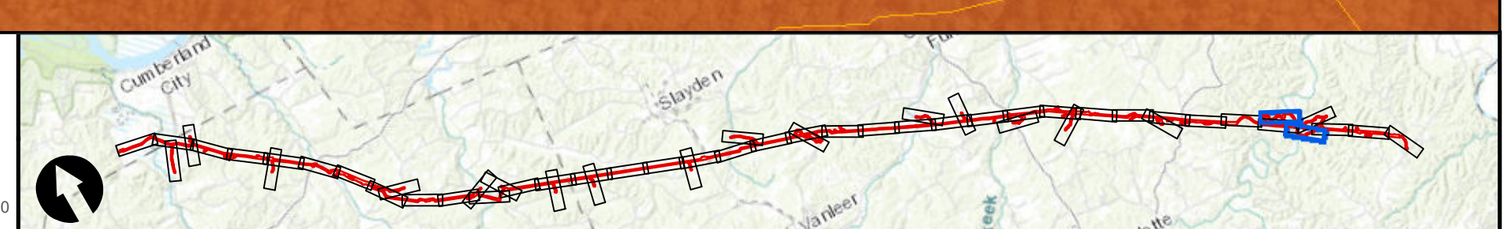
0 Feet 300



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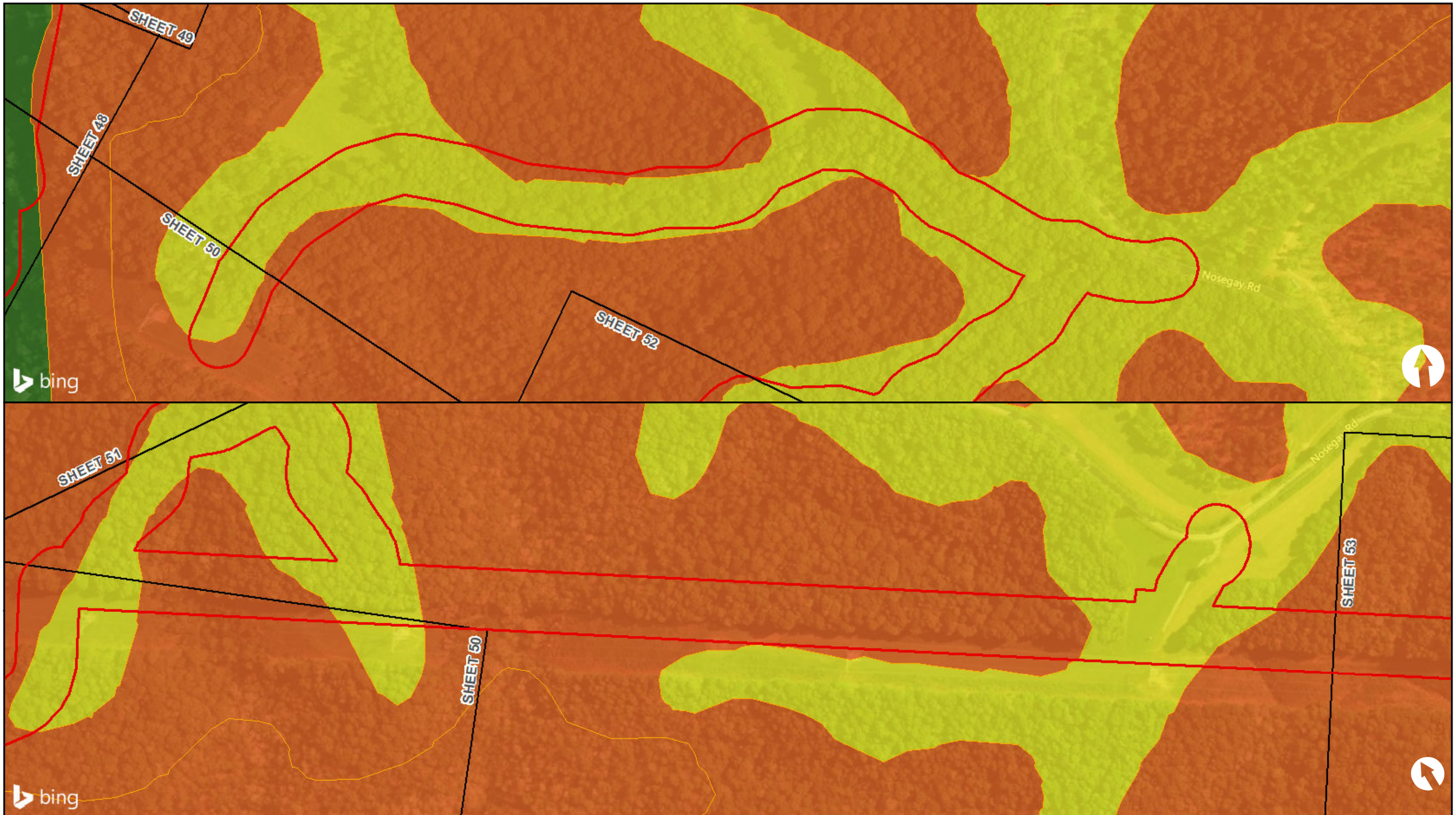

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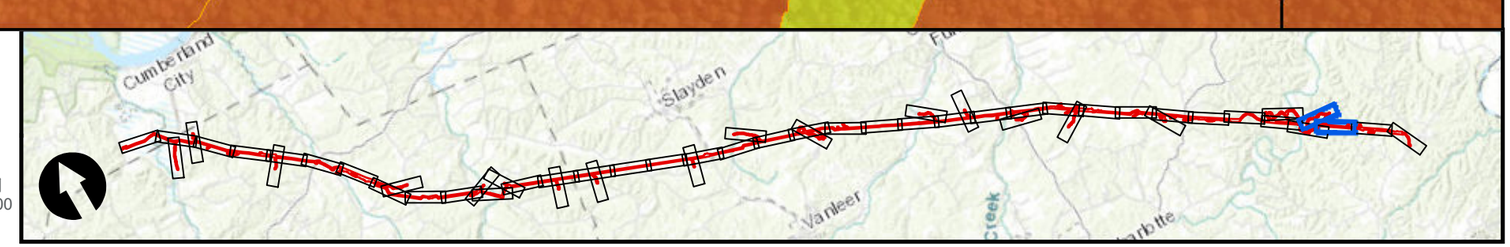

DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery

Nosegay Cemetery

Nosegay Rd

Nosegay Rd

SHEET 52

SHEET 54

bing

Claylick Rd

Claylick Rd

Grove Rd

Pack Annex Rd

Pack Rd

SHEET 53

250

bing

LEGEND

- Alt A Pipeline Corridor
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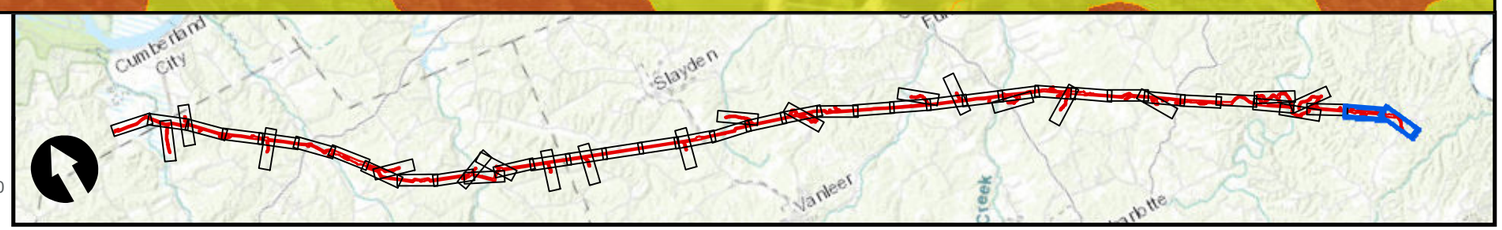
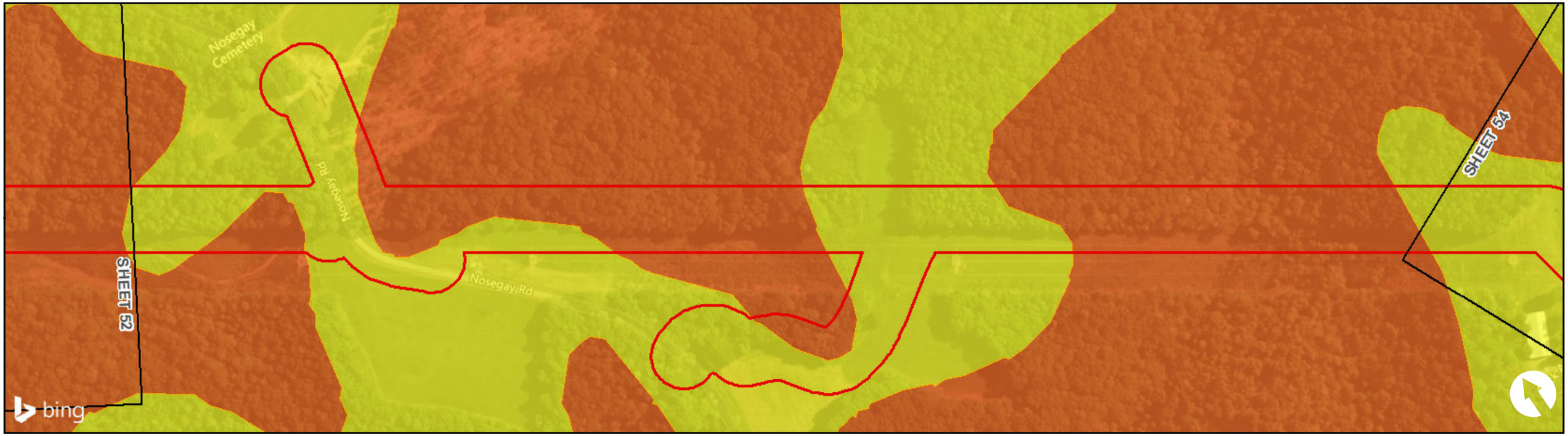
- Not prime farmland

0 Feet 300



DATA SOURCE: USDA NRCS Soils Survey: Dickson, Houston, and Stewart Counties, TN; Bing Hybrid Aerial Imagery



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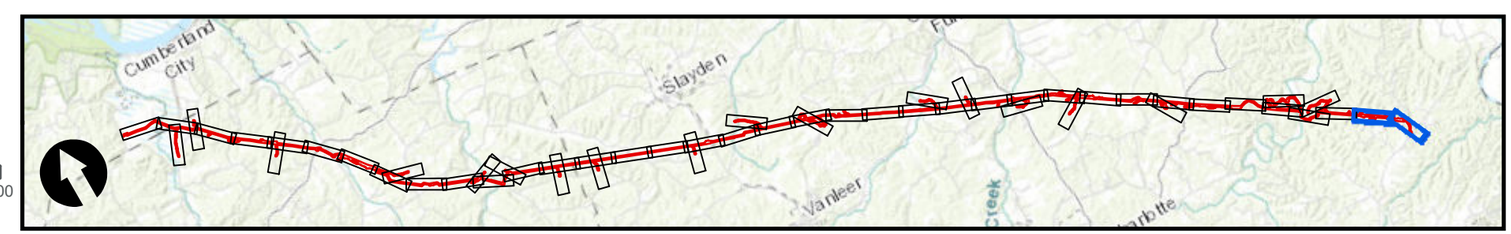
0 Feet 300



Appendix E – CUF Surface Waters Technical Report

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STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
Nashville Environmental Field Office
711 R.S. Gass Boulevard
Nashville, TN 37216
Phone 615-687-7000 Statewide 1-888-891-8332 Fax 615-687-7078

October 11, 2017

Mike Stiefel
TVA - Water Permitting and Compliance
1101 Market Street – BR 4 A
Chattanooga, TN 37402
e-copy: mbstiefel@tva.gov

Re: Hydrologic Determination (DWR ID No. 8753)
Proposed CCR Landfill Site
Cumberland-Lower Barkley Watershed, Stewart County

Dear Mr. Stiefel:

On September 20, 2017, the Division of Water Resources (Division) received a jurisdictional waters determination of hydrologic features report submitted on your behalf by Stan Rudzinski of AMEC Foster Wheeler Environmental & Infrastructure, Inc. (AMEC). Mr. Rudzinski submitted this report as a Qualified Hydrologic Professional (TN QHP No. 1031-TN11). This report concerns 29 water features located on the proposed CCR Landfill Site Property consisting of 850 acres south and east of Old Scott Road, southwest of the Cumberland Fossil Plant (Parcel IDs 123.001.00, 124.057.04, 124.058.00, 124.059.00, 139.006.00), Lat. 36.379449 Long. -87.668337, Cumberland City, Stewart County, Tennessee. This property is within the Cumberland-Lower Barkley watershed and is located on the Cumberland City TN USGS 7.5 minute topographic quad map. Please note that all geographic coordinates provided in this letter have a limited precision and should be considered approximate.

Based on the information and documentation submitted, my observations and the division's rules and guidance regarding hydrologic determinations, the division accepts the jurisdictional determination of the water features as portrayed in the submitted AMEC report and attached maps (Map Attachments, Figure 1 & 2). Copies of Figures 1 & 2 are attached to this letter. Water features shown in yellow and labeled as WWC have been determined to be wet weather conveyances. Water features shown in blue and labeled as STR have been determined to be streams. The water features are shown on the attached map and are listed below:

Water Feature	Starting Coordinates (Lat./Long.)	Ending Coordinates (Lat./Long.)
STR #1	36.372025/-87.68193	36.37513/-87.68263
STR #2	36.378529/-87.683035	36.38765/-87.676129
STR # 3	36.386997/-87.679359	36.387577/-87.678087
STR # 4	36.387497/-87.678946	36.38724/-87.678462
STR # 5	36.380382/-87.674857	36.380453/-87.673885
STR # 6	36.381005/-87.675113	36.380537/-87.674452
WWC # 1	36.374583/-87.675666	36.378329/-87.670677
WWC # 2	36.37374/-87.674893	36.374643/-87.672775
WWC # 3	36.377613/-87.670544	36.378238/-87.670709
WWC # 4	35.37651/-87.676759	36.378565/-87.67133
WWC # 5	36.37565/-87.68153	36.375105/-87.682638
WWC # 6	36.376442/-87.686125	36.378139/-87.683588
WWC # 7	36.378562/-87.683755	36.378442/-87.683143
WWC # 8	36.384771/-87.679239	36.383314/-87.681729
WWC # 9	36.383512/-87.672454	36.383128/-87.671503
WWC # 11	36.378958/-87.677576	36.38022/-87.675438

In addition, AMEC identified nine wetlands on site shown on the map in green. These wetlands are jurisdictional and are identified on Figure 1 and listed below:

Feature	General Location(lat./long.)	Size (acres)
Wetland 1	36.3888/-87.6828	1.60
Wetland 2	36.3880/-87.3800	0.03
Wetland 3	36.3877/-87.6785	0.14
Wetland 4	36.3875/-87.6765	2.30
Wetland 5	36.3813/-87.6787	1.30
Wetland 6	36.3823/-87.6666	111.40
Wetland 7	36.379/-87.668	3.30
Wetland 8	36.3795/-87.6711	11.0
Wetland 12	36.3870/-87.6777	6.90

Alterations to wetlands may only be performed under coverage of and conformance to a valid *Aquatic Resources Alteration Permit* (ARAP).

Amec also identified four ponds onsite. These ponds are show in blue on figure 2 and listed below:

Feature	General Location(lat./long.)	Size (acres)
Pond 1	36.375686/-87.675712	2.0
Pond 2	36.376542/-87.673370	2.1
Pond 3	36.380988/-87.675278	0.90
Pond 4	36.380735/-87.674819	0.50

These ponds have no inlet or outlet channels, do not contain wetland characteristics, and do not appear to be connected to groundwater. These ponds were determined to be non-jurisdictional.

Only the features addressed above were assessed during this investigation. Prior to conducting any work within the abovementioned wet weather conveyances and wetland areas, a valid *Aquatic Resources Alteration Permit* (ARAP) must be obtained from the division. The abovementioned wet weather conveyances may be altered under the *General Aquatic Resource Permit for the Alteration of Wet Weather Conveyances* as long as all permit conditions can be met. Specifically, but not limited to, Condition 2 that requires that material not be placed in a location or manner so as to impair surface water flow into or out of the wetland area. Additional information about the ARAP can be found at http://www.tn.gov/environment/article/permit-water-aquatic-resource-alteration-permit.

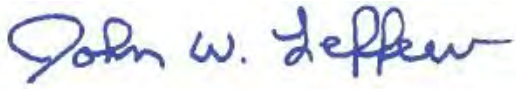
If the disturbed area of this project is one acre or greater, coverage under the *General NPDES Permit for Stormwater Discharges from Construction Activities (CGP)* will be required from this division before any clearing or earth moving activities are started. Information on the construction stormwater permit is available online at http://www.tn.gov/environment/article/permit-water-npdes-stormwater-construction-permit. Please be advised that effective erosion prevention and sediment control measures must be used during the construction phase of this project to prevent the discharge of pollutants to waters of the State.

Hydrologic determinations are advised and governed by Tennessee Department of Environment and Conservation (TDEC) rules and regulations, and therefore only apply to the State's permitting process. Because these and other various water features on-site may potentially also be considered jurisdictional Waters of the United States, any alterations to them should only be performed after consultation with the U.S. Army Corps of Engineers.

I appreciate the opportunity to assess the site prior to site plan finalization and initiation of construction activities. Because natural variation and human activities can alter hydrologic conditions, the division reserves the right to reassess the status of the water features in the future.

Thank you for your interest in water quality in Tennessee. If you have any questions or need additional information, please contact me at 615-687-7106 or by email at John.Leffew@tn.gov.

Sincerely,



John W. Leffew
Division of Water Resources

cc: Stan Rudzinski, AMEC, Stan.Rudzinski@amecfw.com
Jason Repsher, TDEC-DSWM, Jason.Repsher@tn.gov .
U.S. Army Corp of Engineers, NashvilleRegulatory@usace.army.mil

Enclosure: Map Attachments

Figure 1

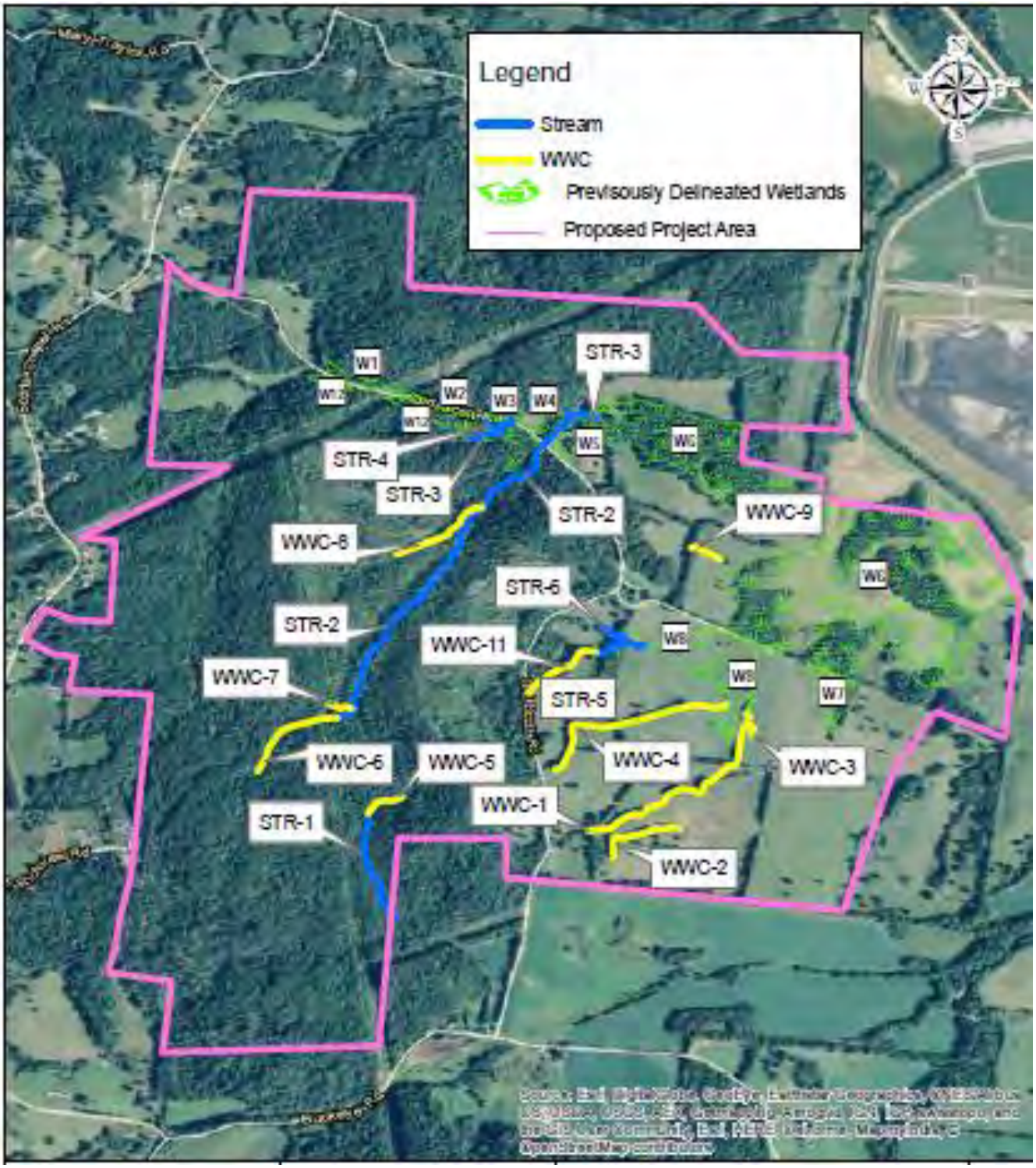
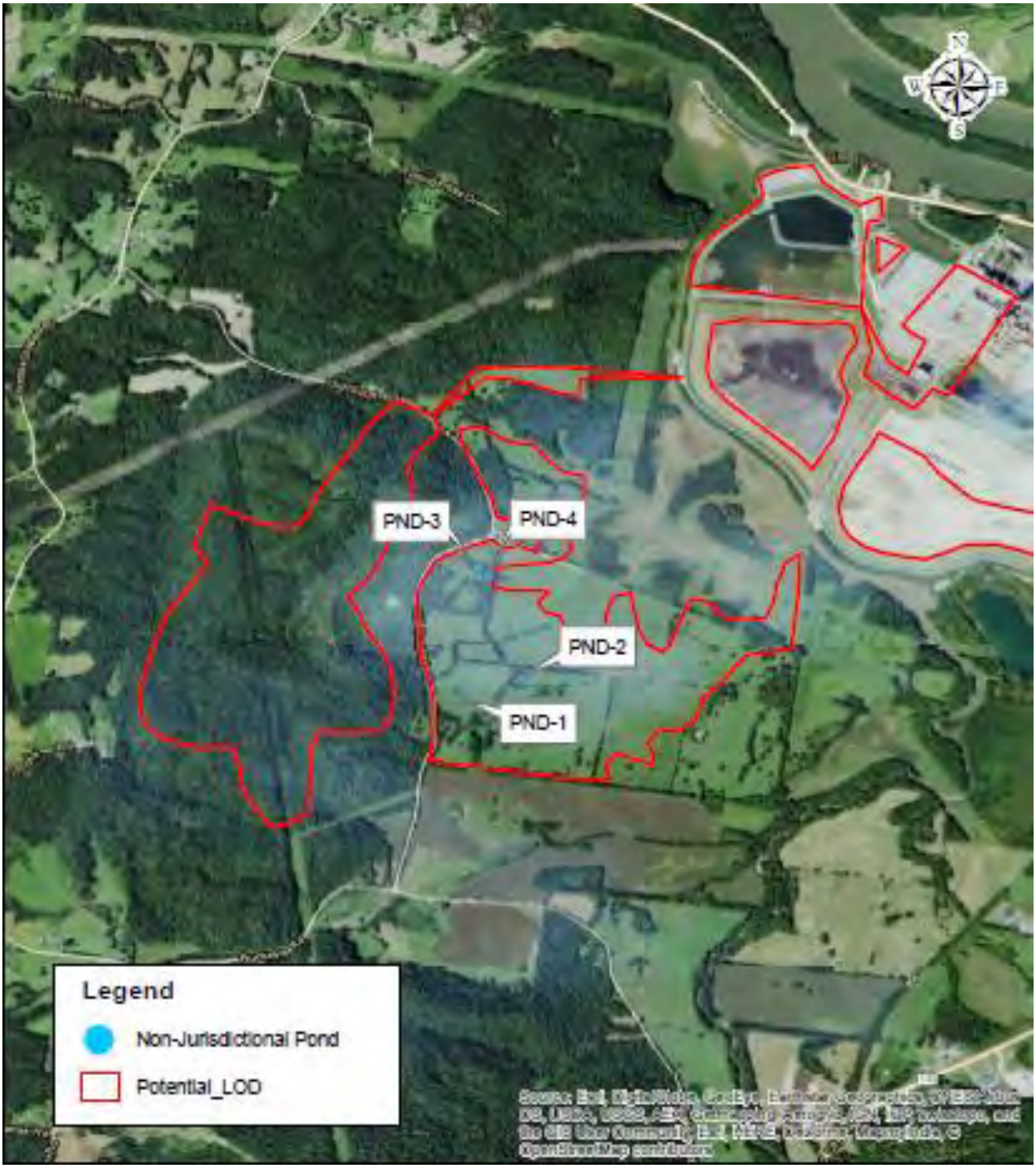

Legend
Stream
WWC
Previsously Delineated Wetlands
Proposed Project Area
STR-3
W1
W2
W3
W4
W5
W6
W7
W8
W9
STR-4
STR-3
STR-2
WWC-9
WWC-8
STR-6
STR-2
WWC-11
WWC-7
STR-5
WWC-6
WWC-5
WWC-4
WWC-3
WWC-1
STR-1
WWC-2

Figure 2


PND-3
PND-4
PND-2
PND-1
Legend
Non-Jurisdictional Pond
Potential_LOD

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
3701 Bell Road
NASHVILLE, TENNESSEE 37214

REPLY TO
ATTENTION OF:

OCT 0 2 2017

Regulatory Division

SUBJECT: File No. LRN-2017-00257; Preliminary Jurisdictional Determination for TVA Cumberland City Fossil Plant Proposed Landfill and Borrow Area located along Wells Creek, in Cumberland City, Stewart County, Tennessee

Mr. Mike Stiefel
TVA – Water Permitting and Compliance
1101 Market Street – BR 4A
Chattanooga, Tennessee 37402

Dear Mr. Stiefel:

This letter is in regard to a Preliminary Jurisdictional Determination (PJD) request for property located at TVA Cumberland City Fossil Plant proposed for landfill and borrow area expansion, located along Wells Creek, in Cumberland City, Stewart County, Tennessee (latitude 36.3808; longitude-87.6749). The property being reviewed is approximately 800-acres in size and shown on the attached location map. This project has been assigned Department of the Army (DA) File #LRN-2017-00257. Please refer to this number in all future correspondence regarding this project.

The U.S. Army Corps of Engineers (USACE) has regulatory responsibilities pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403). Under Section 10, the USACE regulates any work in, or affecting, navigable waters of the U.S. No navigable waterways are located within the property boundaries as shown on the enclosed location map. Under Section 404, the USACE regulates the discharge of dredge and/or fill material into waters of the U.S. (WOUS) including wetlands.

Based on information available and a stream review of the property, this office has determined that approximately 5,440 linear feet of perennial streams, 1,670 linear feet of intermittent streams, 8,060 linear feet of ephemeral streams, and 140.13 acres of wetlands were documented within the project review area. These features **may be** jurisdictional WOUS in accordance with 33 CFR 331.2 and a PJD has been prepared (Enclosure 1). This PJD is non-binding, cannot be appealed and only provides a written indication that WOUS may be present on-site. For purposes of computation of impacts, compensatory mitigation requirements, if necessary, and other resource protection measures, a permit decision made on the basis of a PJD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional WOUS.

Four pond areas (labeled PD-1, 2, 3, and 4) are located within the property and are included in the PJD as potential WOUS; however, these features are currently being evaluated as an Approved Jurisdictional Determination (AJD). If the AJD evaluation verifies these as isolated features, they would not be considered jurisdictional WOUS. The AJD review areas are shown on the enclosed

location map and correspondence regarding the AJD verification of these features will be provided upon completion of their evaluation.

Enclosed with this letter is a copy of the PJD form (Enclosure 1) and Request for Appeal (RFA) form (Enclosure 2) that explains available options regarding this determination. This determination is only valid for the review area shown on the attached location map labeled "TVA Property/Review Area for PJD and AJD Purposes for Proposed Landfill and Borrow Area Locations" (Enclosure 3).

If you agree with the findings of this PJD and understand your options regarding the same, please sign and date the form and return it to this office within 30 days from the date of this letter.

If you wish, you may request an approved jurisdictional determination (which may be appealed) by contacting this office. Also, you may provide new information for further consideration by the Corps to re-evaluate the PJD.

You can submit the signed copy of the PJD and/or contact Amy Robinson if you have questions in regards to this matter, at the letterhead address above, telephone 615-369-7507, fax 615-369-7501, or email amy.m.robinson@usace.army.mil.

Sincerely,

Timothy C. Wilder
Chief, West Branch
Regulatory Division
U.S. Army Corps of Engineers

Copy Furnished:
Mr. Stan Rudzinski
Amec Foster Wheeler Environmental
3800 Ezell Road, Suite 100
Nashville, TN 37211

Enclosures:
1 - Preliminary Jurisdictional Determination Form
2 – Request for Appeal (RFA) Form
3 – Location Map of Review Area for PJD and AJD Purposes

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): September 20, 2017

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:
Applicant: Tennessee Valley Authority (TVA), Cumberland Fossil Plant, 1101 Market Place, Chattanooga, TN 37402
Consultant: Amec, Foster, Wheeler Environmental & Infrastructure, Inc., 3800 Ezell Road, Suite 100, Nashville, TN 37211

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:
Nashville District, Regulatory (RD); Cumberland Fossil Plant, Landfill and Borrow Areas, Cumberland City, Stewart County, TN; File #LRN-2017-00257

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION: (SEE THE ATTACHED TABLE FOR MULTIPLE WATERBODIES AT DIFFERENT SITES)
State: TN County/parish/borough: Stewart City: Cumberland City

Center coordinates of site (in degree decimal format): Lat. 36.3808°; Long.-87.6749°
Universal Transverse Mercator:

Name of nearest waterbody: Wells Creek

Identify (estimate) amount of waters in the review area: perennial, intermittent, and ephemeral
Non-wetland waters: approx 5,440 linear feet of perennial, 1,670 linear feet of intermittent, and 8,160 linear feet of ephemeral channel
Cowardin Class: R3, R4, and R6
Stream Flow: perennial, intermittent, and ephemeral
Wetlands: 143.5 acres (includes 5.5 acres to be further reviewed as AJD)
Cowardin Class: PEM and PFO

Name of any water bodies on the site that have been identified as Section 10 waters:
Tidal:
Non-Tidal:

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
X Office (Desk) Determination. Date: September 27, 2017

X Field Determination. Date(s): May 22, 2017

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is herby advised of his or her option to request and obtain an approved jurisdictional determination n(JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable. This preliminary JD finds that there *"may be"* waters of the of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

.'ORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should ,ncluded in case file and, where checked and requested, appropriately reference sources below):

X Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant:
Maps and plans provided by TVA and Amec Foster Wheeler, Inc.

X Data sheets prepared/submitted by or on behalf of the applicant/consultant.
X Office concurs with data sheets/delineation report.
Revisions submitted 7/28/2017 and 9/20/2017.

Office does not concur with data sheets/delineation report.

Data sheets prepared by the Corps:

X Corps navigable waters' study: Section 10 Navigable waterway list

U.S. Geological Survey Hydrologic Atlas: .
USGS NHD data.
USGS 8 and 12 digit HUC maps.

X U.S. Geological Survey map(s). Cite scale & quad name: Cumberland City quadrangle

X USDA Natural Resources Conservation Service Soil Survey: dated 12/29/2016

X National wetlands inventory map(s): dated 12/29/2016

State/Local wetland inventory map(s):

X FEMA/FIRM maps: dated 12/29/2016
100-year Floodplain Elevation (National Geodectic Vertical Datum of 1929)

X Photographs: Aerial (Name & Date): Google Earth, Sep 2015
or Other (Name & Date): Aerials provided by consultant (dated March 2016)

Previous determination(s). File no. and date of response letter:

X Other information (please specify): Onsite inspection by RD on 5/22/2017. TVA's Wetlands Section provided information for previous wetland delineation performed by TVA.

IMPORTANT NOTICE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations:

9/28/17

Signature and Date of
Regulatory Project Manager
(REQUIRED)

Signature and Date of
person requesting preliminary JD
(REQUIRED, unless obtaining
the signature is impracticable).

SITES REVIEWED/ POTENTIAL WATERS OF U.S. FOR PRELIMINARY JD: File #LRN-2017-00257

Site Number:	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area:	Class of aquatic resource:
W-1	36.38881	-87.68282	PEM	1.60 acres	Wetland; Non Sec 10
W-2	36.38894	-87.38001	PEM	0.03 acres	Wetland; Non Sec 10
W-3	36.38772	-87.67856	PEM	2.30 acres	Wetland; Non Sec 10
W-4	36.38753	-87.67653	PEM	2.30 acres	Wetland; Non Sec 10
W-5	36.38133	-87.67874	PEM	1.30 acres	Wetland; Non Sec 10
W-6	36.38232	-87.66673	PEM/PFO	111.40 acres	Wetland; Non Sec 10
W-7	36.37941	-87.66847	PEM	3.30 acres	Wetland; Non Sec 10
W-8	36.37950	-87.67114	PEM	11.0 acres	Wetland; Non Sec 10
W-12	36.38701	-87.67776	PFO	6.90 acres	Wetland; Non Sec 10
STR-1	36.372076	-87.681962	R4	1,280 linear feet	Intermittent; Non Sec 10
STR-2	36.380478	-87.682285	R3	4,600 linear feet	Perennial; Non Sec 10
STR-3	36.387501	-87.678112	R3	700 linear feet	Perennial; Non Sec 10
STR-4	36.387302	-87.678550	R3	140 linear feet	Perennial; Non Sec 10
STR-5	36.380464	-87.674734	R4	250 linear feet	Intermittent; Non Sec 10
STR-6	36.380817	-87.675059	R4	140 linear feet	Intermittent; Non Sec 10
WWC-1	36.374658	-87.675098	R6	1,230 linear feet	Ephemeral; Non Sec 10
WWC-2	36.374363	-87.674693	R6	800 linear feet	Ephemeral; Non Sec 10
WWC-3	36.377873	-87.670522	R6	150 linear feet	Ephemeral; Non Sec 10
WWC-4	36.378173	-87.673806	R6	1,930 linear feet	Ephemeral; Non Sec 10
WWC-5	36.375508	-87.682265	R6	410 linear feet	Ephemeral; Non Sec 10
WWC-6	36.377614	-87.685471	R6	1,070 linear feet	Ephemeral; Non Sec 10
WWC-7	36.378568	-87.683766	R6	250 linear feet	Ephemeral; Non Sec 10
WWC-8	36.384511	-87.679605	R6	1,030 linear feet	Ephemeral; Non Sec 10
WWC-9	36.383450	-87.672045	R6	330 linear feet	Ephemeral; Non Sec 10
WWC-11	36.380269	-87.675740	R6	860 linear feet	Ephemeral; Non Sec 10
PND-1	36.375686	-87.675712	PO	2.0 acres	Pond; Non Sec 10 (AJD review)
PND-2	36.376542	-87.673370	PO	2.10 acres	Pond; Non Sec 10 (AJD review)
PND-3	36.380988	-87.675278	PO	0.90 acres	Pond; Non Sec 10 (AJD review)
PND-4	36.380735	-87.674819	PO	0.50 acres	Pond; Non Sec 10 (AJD review)

ENCLOSURE 2

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: TVA Cumberland City Fossil Plant	File Number: LRN-2017-00257	Date:
Attached is:		See Section:
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
	APPROVED JURISDICTIONAL DETERMINATION	D
X	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/CECW/Pages/reg_materials.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

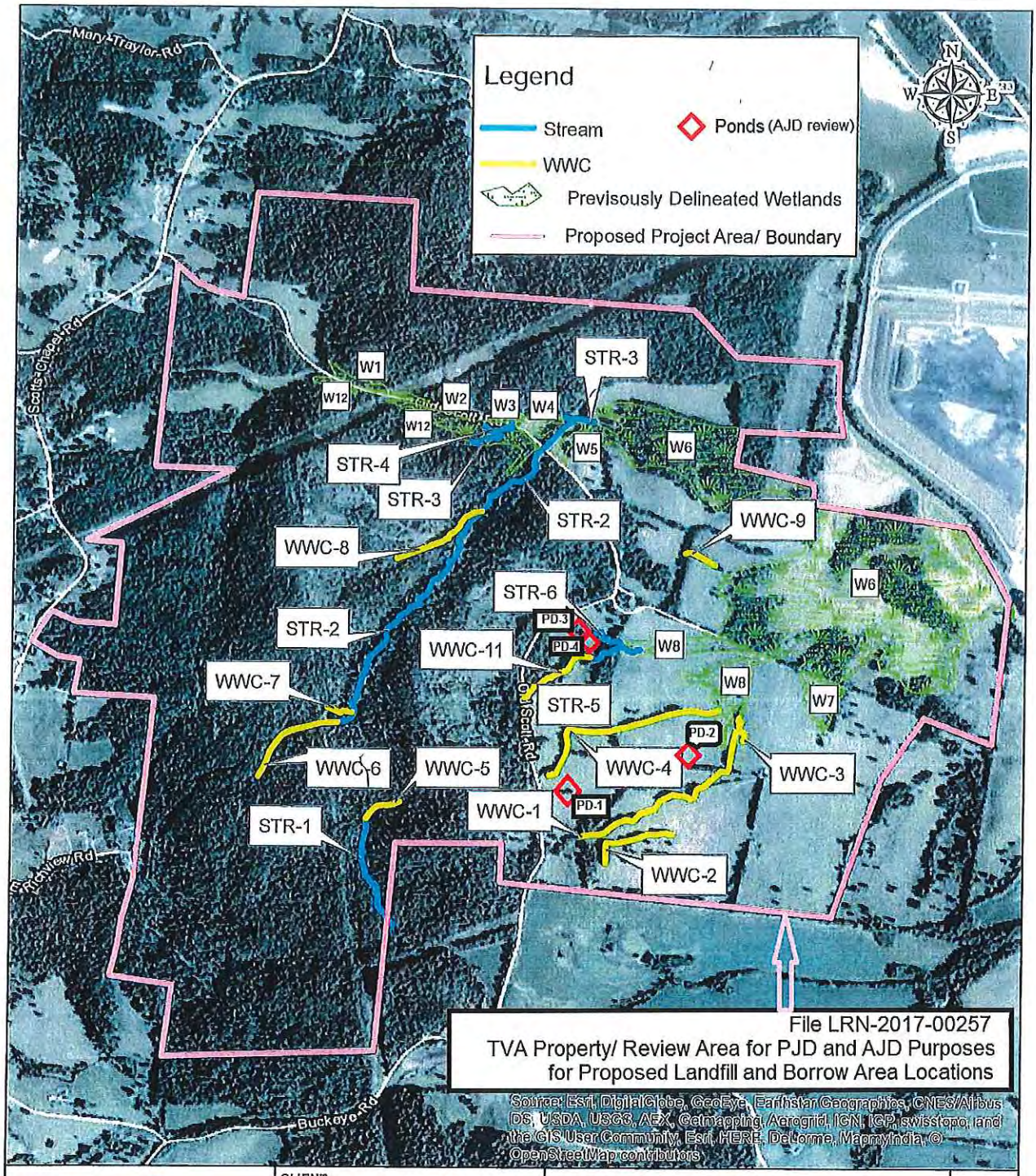
ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:	If you only have questions regarding the appeal process you may also contact: **Appeal Officer** **U.S. Army Corps of Engineers** **Great Lakes and Ohio River Division** **ATTN: Appeal Review Officer** **550 Main Street RM 10032** **Cincinnati, OH 45202-3222** **Telephone: 513-684-6212; Fax 513-684-2460**

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

Signature of appellant or agent.	Date:	Telephone number:



amec foster wheeler	CLIENT: Tennessee Valley Authority	SITE LOCATION: TVA Cumberland Fossil Plant Proposed Landfill and Borrow Areas Cumberland City, Stewart County, Tennessee	Figure No.
Amec Foster Wheeler Environment & Infrastructure, Inc. 3800 Ezell Road, Suite 100 Nashville, TN 37211	TITLE: Jurisdictional Stream and Wetland Location Map	SCALE: 1" = 2000' DATE: 05/30/2017 Project Number: 326216056.04.01 DRAWN BY: F. Glover CHECKED BY: S. Rudzinski ESRI TOPOGRAPHIC MAP	

Cumberland Fossil Plant – Comprehensive Site Study

Technical Report

ESCS Request ID: 34462
Prepared by Craig L. Phillips, Aquatic Community Ecologist
Zachary Luttrell, Aquatic Biologist Contractor, Johnson Service Group Inc.

September 2021

Introduction

A comprehensive survey to document the biological resources present within the Cumberland Fossil Plant (CUF) site boundary was conducted September 1, 2021. Hydrologic determinations were made using the Tennessee Division of Water Pollution Control (Version 1.5) field forms by Tennessee qualified hydrologic professional In-Traing (Zachary Luttrell). Locations were mapped in the field using a Trimble R1 receiver and shapefiles created in ArcMap 10.5. A Normal Weather Conditions calculation was done and determined that weather conditions at the time of survey were abnormally wet (see Appendix X). Previous surveys of the CUF proposed landfill were conducted by AMEC Foster Wheeler.

Results

A total of 25 streams occur within the CUF plant boundary. Of those streams 4 are considered perennial, 7 considered intermittent, and 14 considered wet-weather conveyances/ ephemeral streams. A listing of streams documented is provided in Appendices X.

Three classes were used to indicate the current condition of streamside vegetation across the length of the stream, as defined below, and accounted for in Table 3-1.

- Forested - Riparian area is fully vegetated with trees, shrubs, and herbaceous plants. Vegetative disruption from mowing or grazing is minimal or not evident. Riparian width extends more than 60 feet on either side of the stream.
- Partially forested - Although not forested, sparse trees and/or scrub-shrub vegetation is present within a wider band of riparian vegetation (20 to 60 feet). Disturbance of the riparian zone is apparent.
- Non-forested - No or few trees are present within the riparian zone. Significant clearing has occurred, usually associated with pasture or cropland.

Table 3-1. Riparian Condition of Perennial and Intermittent Streams Located Within the CUF Plant Boundary.

Riparian Condition	# Perennial Streams	# Intermittent Streams	Total
Forested	3	3	**6**
Partially forested	1	4	**5**
Nonforested			
Total	**4**	**7**	**11**

Appendix X

Normal Weather Conditions Calculation

		Long-term rainfall records			TN-HT-5				
	Month	Minus One Std. Dev. (Dry)	Normal (Mean inches)	Plus One Std. Dev. (Wet)	Actual Rainfall (inches)	Condition (dry, wet, normal)	Condition value	Month weight value	of previous two columns
1st prior month*	8	1.27417463	3.3022	5.33022537	12.1	wet	3	x 3	9
2nd prior month*	7	2.02921299	3.8506	5.67198701	5.3	normal	2	x 2	4
3rd prior month*	6	1.75529414	3.9742	6.19310586	4.14	normal	2	x 1	2
								Sum =	15

If sum is:	Condition	Value
6-9	Dry	1
10-14	Normal	2
15-18	Wet	3

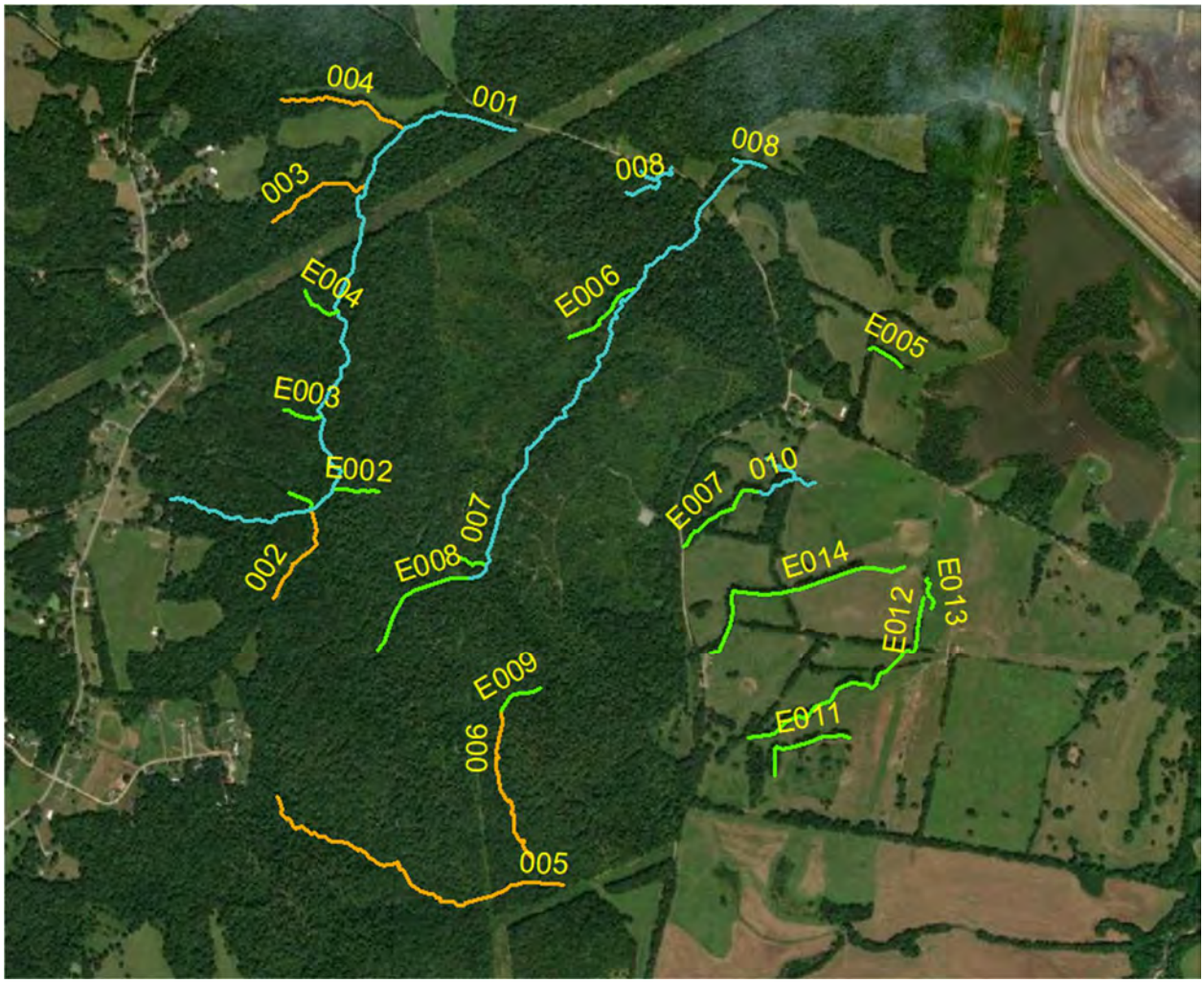
Weather Conditon
WET

	Std. Dev.			Mean	
Month	"Paste"	Inches	Month	"Paste"	Inches
1	268.8397	2.688397	1	418.98	4.1898
2	227.0147	2.270147	2	421.96	4.2196
3	261.7441	2.617441	3	508.38	5.0838
4	190.2911	1.902911	4	417.22	4.1722
5	229.0973	2.290973	5	432.82	4.3282
6	221.8906	2.218906	6	397.42	3.9742
7	182.1387	1.821387	7	385.06	3.8506
8	202.8025	2.028025	8	330.22	3.3022
9	197.5197	1.975197	9	319.3	3.193
10	156.0957	1.560957	10	282.62	2.8262
11	224.9647	2.249647	11	418.08	4.1808
12	275.9034	2.759034	12	458.48	4.5848

Streams within the CUF Plant Property.

Sequence ID	Stream Type	Stream Name	Field Notes	Latitude	Longitude
001	Perennial	Scott Branch	Fish, crayfish, amphibians, flowing water.	36.388622	-87.683864
002	Intermittent	n/a	4 by 2ft stream, sorting, defined bed and bank.	36.378581	-87.688130
003	Intermittent	n/a	5 by 2ft stream.	36.386406	-87.688713
004	Intermittent	n/a	3 by 2ft stream.	36.388895	-87.688454
005	Intermittent	n/a	Stream gets deeper as it goes downstream, lots of geomorphology, amphibians, big head cuts, flowing water, big areas of breaks with no flowing water and veg in the channel, riffle run pool seq.	36.370758	-87.684369
006	Intermittent	n/a	Field work done by third party.	36.373144	-87.682389
007	Perennial	n/a	Field work done by third party.	36.380603	-87.682027
008	Perennial	n/a	Field work done by third party.	36.386917	-87.679244
009	Perennial	n/a	Field work done by third party.	36.387344	-87.678837
010	Intermittent	n/a	Field work done by third party.	36.380237	-87.675040
011	Intermittent	n/a	Field work done by third party.	36.380828	-87.674948
E001	WWC	n/a	Sign of water flow during rain events	36.379799	-87.688364
E002	WWC	n/a	Steep ravine	36.380032	-87.686806
E003	WWC	n/a	Sorting, root grade controls, moderate bed and bank	36.381736	-87.688405
E004	WWC	n/a	Steep ravine	36.384226	-87.688042
E005	WWC	n/a	Field work done by third party	36.383407	-87.672005
E006	WWC	n/a	Field work done by third party	36.383699	-87.680530
E007	WWC	n/a	Field work done by third party	36.379196	-87.677258
E008	WWC	n/a	Field work done by third party	36.377438	-87.685553
E009	WWC	n/a	Field work done by third party	36.375466	-87.681970
E010	WWC	n/a	Field work done by third party	36.378436	-87.683439
E011	WWC	n/a	Field work done by third party	36.374396	-87.674135

E012	WWC	n/a	Field work done by third party	36.375371	-87.673405
E013	WWC	n/a	Field work done by third party	36.378229	-87.670699
E014	WWC	n/a	Field work done by third party	36.377189	-87.676173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Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

Named Waterbody: Scott Branch		Date/Time: 9/1/2021
Assessors/Affiliation: Zach Luttrell - TVA		Project ID : 536018
Site Name/Description: Seq ID: 001 (ASZ001)		
Site Location: TVA Cumberland Fossil Plant		
HUC (12 digit): 051302050403	Latitude: 36.388622	
Previous Rainfall (7-days) : 3 inches, NOAA Clarksville	Longitude: -87.683864	
Precipitation this Season vs. Normal : elevated Source of recent & seasonal precip. data :		
Watershed Size : 36,472 acres	County: Stewart	
Soil Type(s) / Geology :	Source:	
Surrounding Land Use : Rural		
Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	☐	WWC
2. Defined bed and bank absent, vegetation composed of upland and FACU species	☐	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A	☐	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	☐	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	☐	Stream
6. Presence of fish (except *Gambusia*)	☑	Stream
7. Presence of naturally occurring ground water table connection	☐	Stream
8. Flowing water in channel and 7 days since last precip >0.1" in local watershed	☐	Stream
9. Evidence watercourse has been used as a supply of drinking water	☐	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

Overall Hydrologic Determination = STREAM

Secondary Indicator Score (if applicable) = 0.00

Justification / Notes :

Fish observed.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 0.00)	Absent	Weak	Moderate	Strong	
1. Continuous bed and bank	0	1	2	3	0
2. Sinuous channel	0	1	2	3	0
3. In-channel structure: riffle-pool sequences	0	1	2	3	0
4. Sorting of soil textures or other substrate	0	1	2	3	0
5. Active/relic floodplain	0	0.5	1	1.5	0
6. Depositional bars or benches	0	1	2	3	0
7. Braided channel	0	1	2	3	0
8. Recent alluvial deposits	0	0.5	1	1.5	0
9. Natural levees	0	1	2	3	0
10. Headcuts	0	1	2	3	0
11. Grade controls	0	0.5	1	1.5	0
12. Natural valley or drainageway	0	0.5	1	1.5	0
13. At least second order channel on existing USGS or NRCS map	0	1	2	3	0

B. Hydrology (Subtotal = 0.00)	Absent	Weak	Moderate	Strong	
14. Subsurface flow/discharge into channel	0	1	2	3	0
15. Water in channel and >48 hours since sig. rain	0	1	2	3	NA
16. Leaf litter in channel	1.5	1	0.5	0	NA
17. Sediment on plants or on debris	0	0.5	1	1.5	0
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5	0
19. Hydric soils in channel bed or sides of channel	No = 0		Yes = 1.5		0

C. Biology (Subtotal = 0.00)	Absent	Weak	Moderate	Strong	
20. Fibrous roots in channel bed [1]	3	2	1	0	NA
21. Rooted plants in the thalweg [1]	3	2	1	0	NA
22. Crayfish in stream (exclude in floodplain)	0	1	2	3	0
23. Bivalves/mussels	0	1	2	3	0
24. Amphibians	0	0.5	1	1.5	0
25. Macrobenthos (record type & abundance)	0	1	2	3	0
26. Filamentous algae; periphyton	0	1	2	3	0
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5	0
28. Wetland plants in channel bed [2]	0	0.5	1	1.5	0

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 0.00

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

Named Waterbody:	Date/Time: 9/1/2021
Assessors/Affiliation: Zach Luttrell - TVA	Project ID : 536018
Site Name/Description: Seq ID: 002 (ASZ002)	
Site Location: TVA Cumberland Fossil Plant	
HUC (12 digit): 051302050403	Latitude: 36.378581
Previous Rainfall (7-days) : 3 inches, NOAA Clarksville	Longitude: -87.688130
Precipitation this Season vs. Normal : elevated Source of recent & seasonal precip. data :	
Watershed Size : 36,472 acres	County: Stewart
Soil Type(s) / Geology :	Source:
Surrounding Land Use : Rural	
Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight	

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	☐	WWC
2. Defined bed and bank absent, vegetation composed of upland and FACU species	☐	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A	☐	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	☐	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	☐	Stream
6. Presence of fish (except *Gambusia*)	☐	Stream
7. Presence of naturally occurring ground water table connection	☐	Stream
8. Flowing water in channel and 7 days since last precip >0.1" in local watershed	☐	Stream
9. Evidence watercourse has been used as a supply of drinking water	☐	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

Overall Hydrologic Determination = STREAM

Secondary Indicator Score (if applicable) = 17.75

Justification / Notes :

4' by 2' stream, sorting, defined bed and bank, intermittent

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 9.25)	Absent	Weak	Moderate	Strong	
1. Continuous bed and bank	0	1	2	3	2
2. Sinuous channel	0	1	2	3	1.5
3. In-channel structure: riffle-pool sequences	0	1	2	3	1
4. Sorting of soil textures or other substrate	0	1	2	3	2.5
5. Active/relic floodplain	0	0.5	1	1.5	0.5
6. Depositional bars or benches	0	1	2	3	0.5
7. Braided channel	0	1	2	3	0
8. Recent alluvial deposits	0	0.5	1	1.5	0.25
9. Natural levees	0	1	2	3	0
10. Headcuts	0	1	2	3	0
11. Grade controls	0	0.5	1	1.5	0
12. Natural valley or drainageway	0	0.5	1	1.5	1
13. At least second order channel on existing USGS or NRCS map	0	1	2	3	0

B. Hydrology (Subtotal = 6.00)	Absent	Weak	Moderate	Strong	
14. Subsurface flow/discharge into channel	0	1	2	3	2
15. Water in channel and >48 hours since sig. rain	0	1	2	3	2
16. Leaf litter in channel	1.5	1	0.5	0	1.5
17. Sediment on plants or on debris	0	0.5	1	1.5	0.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5	0
19. Hydric soils in channel bed or sides of channel	No = 0		Yes = 1.5		0

C. Biology (Subtotal = 2.50)	Absent	Weak	Moderate	Strong	
20. Fibrous roots in channel bed [1]	3	2	1	0	1
21. Rooted plants in the thalweg [1]	3	2	1	0	1
22. Crayfish in stream (exclude in floodplain)	0	1	2	3	0
23. Bivalves/mussels	0	1	2	3	0
24. Amphibians	0	0.5	1	1.5	0.5
25. Macrobenthos (record type & abundance)	0	1	2	3	0
26. Filamentous algae; periphyton	0	1	2	3	0
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5	0
28. Wetland plants in channel bed [2]	0	0.5	1	1.5	0

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 17.75

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

Named Waterbody:	Date/Time: 9/1/2021
Assessors/Affiliation: Zach Luttrell - TVA	Project ID : 536018
Site Name/Description: Seq ID: 003 (ASZ007)	
Site Location: TVA Cumberland Fossil Plant	
HUC (12 digit): 051302050403	Latitude: 36.386406
Previous Rainfall (7-days) : 3 inches, NOAA Clarksville	Longitude: -87.688713
Precipitation this Season vs. Normal : elevated Source of recent & seasonal precip. data :	
Watershed Size : 36,472 acres	County: Stewart
Soil Type(s) / Geology :	Source:
Surrounding Land Use : Rural	
Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight	

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	☐	WWC
2. Defined bed and bank absent, vegetation composed of upland and FACU species	☐	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A	☐	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	☐	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	☐	Stream
6. Presence of fish (except *Gambusia*)	☐	Stream
7. Presence of naturally occurring ground water table connection	☐	Stream
8. Flowing water in channel and 7 days since last precip >0.1" in local watershed	☐	Stream
9. Evidence watercourse has been used as a supply of drinking water	☐	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

Overall Hydrologic Determination = STREAM

Secondary Indicator Score (if applicable) = 23.50

Justification / Notes :

5' by 2' stream. Geomorphology, Hydrology, and Biology present.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 14.00)	Absent	Weak	Moderate	Strong	
1. Continuous bed and bank	0	1	2	3	2
2. Sinuous channel	0	1	2	3	2
3. In-channel structure: riffle-pool sequences	0	1	2	3	2
4. Sorting of soil textures or other substrate	0	1	2	3	2
5. Active/relic floodplain	0	0.5	1	1.5	1
6. Depositional bars or benches	0	1	2	3	2
7. Braided channel	0	1	2	3	0
8. Recent alluvial deposits	0	0.5	1	1.5	0.5
9. Natural levees	0	1	2	3	0
10. Headcuts	0	1	2	3	1
11. Grade controls	0	0.5	1	1.5	0.5
12. Natural valley or drainageway	0	0.5	1	1.5	1
13. At least second order channel on existing USGS or NRCS map	0	1	2	3	0

B. Hydrology (Subtotal = 4.50)	Absent	Weak	Moderate	Strong	
14. Subsurface flow/discharge into channel	0	1	2	3	2
15. Water in channel and >48 hours since sig. rain	0	1	2	3	0
16. Leaf litter in channel	1.5	1	0.5	0	1.5
17. Sediment on plants or on debris	0	0.5	1	1.5	0.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5	0.5
19. Hydric soils in channel bed or sides of channel	No = 0		Yes = 1.5		0

C. Biology (Subtotal = 5.00)	Absent	Weak	Moderate	Strong	
20. Fibrous roots in channel bed [1]	3	2	1	0	2
21. Rooted plants in the thalweg [1]	3	2	1	0	2
22. Crayfish in stream (exclude in floodplain)	0	1	2	3	0
23. Bivalves/mussels	0	1	2	3	0
24. Amphibians	0	0.5	1	1.5	1
25. Macrobenthos (record type & abundance)	0	1	2	3	0
26. Filamentous algae; periphyton	0	1	2	3	0
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5	0
28. Wetland plants in channel bed [2]	0	0.5	1	1.5	0

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 23.50

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

Named Waterbody:	Date/Time: 9/1/2021
Assessors/Affiliation: Zach Luttrell - TVA	Project ID : 536018
Site Name/Description: Seq ID: 004 (ASZ 008)	
Site Location: TVA Cumberland Fossil Plant	
HUC (12 digit): 051302050403	Latitude: 36.388895
Previous Rainfall (7-days) : 3 inches, NOAA Clarksville	Longitude: -87.688454
Precipitation this Season vs. Normal : elevated Source of recent & seasonal precip. data :	
Watershed Size : 36,472 acres	County: Stewart
Soil Type(s) / Geology :	Source:
Surrounding Land Use : Rural	
Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight	

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge		WWC
2. Defined bed and bank absent, vegetation composed of upland and FACU species		WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A		WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall		WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase		Stream
6. Presence of fish (except *Gambusia*)		Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precip >0.1" in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water		Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

Overall Hydrologic Determination = STREAM

Secondary Indicator Score (if applicable) = 19.00

Justification / Notes :

3' by 2' stream. Geomorphology, Hydrology, and Biology present.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 10.00)	Absent	Weak	Moderate	Strong	
1. Continuous bed and bank	0	1	2	3	2.5
2. Sinuous channel	0	1	2	3	0.5
3. In-channel structure: riffle-pool sequences	0	1	2	3	2
4. Sorting of soil textures or other substrate	0	1	2	3	1
5. Active/relic floodplain	0	0.5	1	1.5	1
6. Depositional bars or benches	0	1	2	3	1
7. Braided channel	0	1	2	3	0
8. Recent alluvial deposits	0	0.5	1	1.5	0
9. Natural levees	0	1	2	3	0
10. Headcuts	0	1	2	3	1
11. Grade controls	0	0.5	1	1.5	0.5
12. Natural valley or drainageway	0	0.5	1	1.5	0.5
13. At least second order channel on existing USGS or NRCS map	0	1	2	3	0

B. Hydrology (Subtotal = 4.50)	Absent	Weak	Moderate	Strong	
14. Subsurface flow/discharge into channel	0	1	2	3	2
15. Water in channel and >48 hours since sig. rain	0	1	2	3	0
16. Leaf litter in channel	1.5	1	0.5	0	1.5
17. Sediment on plants or on debris	0	0.5	1	1.5	0.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5	0.5
19. Hydric soils in channel bed or sides of channel	No = 0		Yes = 1.5		0

C. Biology (Subtotal = 4.50)	Absent	Weak	Moderate	Strong	
20. Fibrous roots in channel bed [1]	3	2	1	0	2
21. Rooted plants in the thalweg [1]	3	2	1	0	2
22. Crayfish in stream (exclude in floodplain)	0	1	2	3	0
23. Bivalves/mussels	0	1	2	3	0
24. Amphibians	0	0.5	1	1.5	0.5
25. Macrobenthos (record type & abundance)	0	1	2	3	0
26. Filamentous algae; periphyton	0	1	2	3	0
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5	0
28. Wetland plants in channel bed [2]	0	0.5	1	1.5	0

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 19.00

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor, Nashville, TN 37243

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

Named Waterbody:	Date/Time: 9/1/2021
Assessors/Affiliation: Zach Luttrell - TVA	Project ID : 536018
Site Name/Description: Seq ID: 005 (ASZ009)	
Site Location: TVA Cumberland Fossil Plant	
HUC (12 digit): 051302050403	Latitude: 36.370758
Previous Rainfall (7-days) : 3 inches, NOAA Clarksville	Longitude: -87.684369
Precipitation this Season vs. Normal : elevated Source of recent & seasonal precip. data :	
Watershed Size : 36,472 acres	County: Stewart
Soil Type(s) / Geology :	Source:
Surrounding Land Use : Rural	
Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight	

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	☐	WWC
2. Defined bed and bank absent, vegetation composed of upland and FACU species	☐	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A	☐	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	☐	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	☐	Stream
6. Presence of fish (except *Gambusia*)	☐	Stream
7. Presence of naturally occurring ground water table connection	☐	Stream
8. Flowing water in channel and 7 days since last precip >0.1" in local watershed	☐	Stream
9. Evidence watercourse has been used as a supply of drinking water	☐	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

Overall Hydrologic Determination = STREAM

Secondary Indicator Score (if applicable) = 26.50

Justification / Notes :

Stream gets deeper as it goes downstream
Lots of Geomorphology and amphibians
Big head cuts, flowing water
Big areas of breaks with no flowing water and veg in the channel
Riffle run pool seq

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 16.50)	Absent	Weak	Moderate	Strong	
1. Continuous bed and bank	0	1	2	3	2.5
2. Sinuous channel	0	1	2	3	2
3. In-channel structure: riffle-pool sequences	0	1	2	3	1
4. Sorting of soil textures or other substrate	0	1	2	3	2.5
5. Active/relic floodplain	0	0.5	1	1.5	1
6. Depositional bars or benches	0	1	2	3	2
7. Braided channel	0	1	2	3	0
8. Recent alluvial deposits	0	0.5	1	1.5	0.5
9. Natural levees	0	1	2	3	0
10. Headcuts	0	1	2	3	3
11. Grade controls	0	0.5	1	1.5	1
12. Natural valley or drainageway	0	0.5	1	1.5	1
13. At least second order channel on existing USGS or NRCS map	0	1	2	3	0

B. Hydrology (Subtotal = 7.00)	Absent	Weak	Moderate	Strong	
14. Subsurface flow/discharge into channel	0	1	2	3	2.5
15. Water in channel and >48 hours since sig. rain	0	1	2	3	2
16. Leaf litter in channel	1.5	1	0.5	0	1
17. Sediment on plants or on debris	0	0.5	1	1.5	0.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5	1
19. Hydric soils in channel bed or sides of channel	No = 0		Yes = 1.5		0

C. Biology (Subtotal = 3.00)	Absent	Weak	Moderate	Strong	
20. Fibrous roots in channel bed [1]	3	2	1	0	1
21. Rooted plants in the thalweg [1]	3	2	1	0	1
22. Crayfish in stream (exclude in floodplain)	0	1	2	3	0
23. Bivalves/mussels	0	1	2	3	0
24. Amphibians	0	0.5	1	1.5	1
25. Macrobenthos (record type & abundance)	0	1	2	3	0
26. Filamentous algae; periphyton	0	1	2	3	0
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5	0
28. Wetland plants in channel bed [2]	0	0.5	1	1.5	0

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 26.50

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Seq ID: 006

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: STR-1	Date/Time: 12/2 10:21
Assessors/Affiliation: SBR/FSL Amec Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Landfill Area		
USGS quad: Erin	HUC (12 digit): 051302050402	Lat/Long: 36.372776 -87.682304
Previous Rainfall (7-days): 1.32" NOAA Clarksville		
Precipitation this Season vs. Normal: very wet wet average dry drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: ± 83 acres	Photos: Y or N (circle) Number: 3	
Soil Type(s) / Geology: Lobelville silt loam		Source: NRCS
Surrounding Land Use: Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge		WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass		WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase		Stream
6. Presence of fish (except *Gambusia*)		Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water		Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 21.5

Justification / Notes: May have been historically altered by logging activities in upper reach.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 15.5)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	3
2. Sinuous channel	0	1	2	3
3. In-channel structure: riffle-pool sequences	0	1	2	3
4. Sorting of soil textures or other substrate	0	1	2	3
5. Active/relic floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Braided channel	0	1	2	3
8. Recent alluvial deposits	0	0.5	1	1.5
9. Natural levees	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map	No = 0		Yes = 3	

B. Hydrology (Subtotal = 1.0)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	1	2	3
15. Water in channel and >48 hours since sig. rain	0	1	2	3
NA 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel	No = 0		Yes = 1.5	

C. Biology (Subtotal = 5.0)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	1	0
21. Rooted plants in channel [1]	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0.5	1	1.5
23. Bivalves/mussels	0	1	2	3
24. Amphibians	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	2	3
26. Filamentous algae; periphyton	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5
28. Wetland plants in channel [2]	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 21.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes: Int. Stream

Seq ID: 007

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

upper mgt reach

County: Stewart	Named Waterbody: STR-2	Date/Time: 12/2 1130am
Assessors/Affiliation: SBR / JSL Amec Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Landfill Area		
USGS quad: Cumberland City	HUC (12 digit): 05130205 0402	Lat/Long: 36.378243 -87.683229
Previous Rainfall (7-days): 1.32" NOAA Clarksville, TN		
Precipitation this Season vs. Normal: very wet wet average (dry) drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: ± 2.15 Acres	Photos: (Y) or N (circle) Number: 6	
Soil Type(s) / Geology: Lobelville silt loam & Humphreys gravelly SL		Source: NRCS
Surrounding Land Use: Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 21.0

Justification / Notes: May have historical alterations due to logging operations.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 16)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	(3)
2. Sinuous channel	0	1	2	(3)
3. In-channel structure: riffle-pool sequences	0	1	(2)	3
4. Sorting of soil textures or other substrate	0	1	(2)	3
5. Active/relic floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	(0)	0.5	1	1.5
9. Natural levees	0	(1)	2	3
10. Headcuts	0	(1)	2	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	0.5	1	(1.5)
13. At least second order channel on existing USGS or NRCS map	(No = 0)		Yes = 3	

B. Hydrology (Subtotal = 1)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	(0)	1	2	3
15. Water in channel and >48 hours since sig. rain	(0)	1	2	3
N/A 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	(0)	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	(1)	1.5
19. Hydric soils in stream bed or sides of channel	(No = 0)		Yes = 1.5	

C. Biology (Subtotal = 4)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	(1)	0
21. Rooted plants in channel [1]	(3)	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0.5	1	1.5
23. Bivalves/mussels	0	1	2	3
24. Amphibians	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	2	3
26. Filamentous algae; periphyton	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5
28. Wetland plants in channel [2]	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 21.0

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes: Stream

Seq ID: 007

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: STR-2	Date/Time: 12/7/16 12:05pm
Assessors/Affiliation: SBR / FSL		Project ID :
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Landfill Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.380039 -87.682667
Previous Rainfall (7-days) : 1.32" NOAA Clarksville, TN		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : NOAA Clarksville		
Watershed Size : ± 215 Acres	Photos: Y or N (circle) Number : 2	
Soil Type(s) / Geology : Lobelville silt loam		Source: NRCS
Surrounding Land Use : Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)		Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water		Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 29.0

Justification / Notes : - water in channel @ approx. ½ reach downgradient.
- Fish in channel
- Historically altered by logging & pipe

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 17)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	3
2. Sinuous channel	0	1	2	3
3. In-channel structure: riffle-pool sequences	0	1	2	3
4. Sorting of soil textures or other substrate	0	1	2	3
5. Active/relic floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Braided channel	0	1	2	3
8. Recent alluvial deposits	0	0.5	1	1.5
9. Natural levees	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map	No = 0		Yes = 3	

B. Hydrology (Subtotal = 3.5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	1	2	3
15. Water in channel and >48 hours since sig. rain	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel	No = 0		Yes = 1.5	

NA

C. Biology (Subtotal = 8.5)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	1	0
21. Rooted plants in channel [1]	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0.5	1	1.5
23. Bivalves/mussels	0	1	2	3
24. Amphibians	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	* 2	3
26. Filamentous algae; periphyton	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5
28. Wetland plants in channel [2]	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = _____

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes : * salamander
Odonate
water penny
crayfish
mayfly
stone fly
creek chub

Seq ID: 008

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: STR 3	Date/Time: 11/2 1:30 pm
Assessors/Affiliation: SBR / TSL Anna Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Landfill Area		
USGS quad: Cumberland City	HUC (12 digit): 05130205 0402	Lat/Long: 36.387097 -87.67852
Previous Rainfall (7-days): 1.32" NOAA Clarksville, TN		
Precipitation this Season vs. Normal: very wet wet average dry drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: 5400 acres	Photos: (Y) or N (circle) Number: 4	
Soil Type(s) / Geology: Melvin silt loam		Source: NRCS
Surrounding Land Use: Forested County road to the north		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	(Stream)
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water		Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 33

Justification / Notes:

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	(3)
2. Sinuous channel	0	1	2	(3)
3. In-channel structure: riffle-pool sequences	0	1	(2)	3
4. Sorting of soil textures or other substrate	0	1	(2)	3
5. Active/relic floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Braided channel	0	(1)	2	3
8. Recent alluvial deposits	0	(0.5)	1	1.5
9. Natural levees	0	(1)	2	3
10. Headcuts	0	(1)	2	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	0.5	1	(1.5)
13. At least second order channel on existing USGS or NRCS map	(No = 0)		Yes = 3	

B. Hydrology (Subtotal = 7)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	(1)	2	3
15. Water in channel and >48 hours since sig. rain	0	1	2	(3)
N/A 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	0	(0.5)	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	(1)	1.5
19. Hydric soils in stream bed or sides of channel	No = 0		Yes = (1.5)	

C. Biology (Subtotal = 7)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	(3)	2	1	0
21. Rooted plants in channel [1]	(3)	2	1	0
22. Crayfish in stream (exclude in floodplain)	(0)	0.5	1	1.5
23. Bivalves/mussels	(0)	1	2	3
24. Amphibians	(0)	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	* (2)	3
26. Filamentous algae; periphyton	(0)	1	2	3
27. Iron oxidizing bacteria/fungus	(0)	0.5	1	1.5
28. Wetland plants in channel [2]	(0)	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 31.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes: Minnows observed @ old wooden bridge.

* Mayfly
Stone fly
Scud
Odonate
chironomid
crayfish
creek chub
water strider
sliders & cooters

Seq ID: 009

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: STR 4	Date/Time: 12/2 2:00pm
Assessors/Affiliation: SBR/FSL Amy Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Landfill Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.387342 -87.678282
Previous Rainfall (7-days): 1.32" NOAA Clarksville, TN		
Precipitation this Season vs. Normal: very wet wet average dry drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: < 5.0 acres	Photos: (Y) or N (circle) Number: 3	
Soil Type(s) / Geology: Melvin silt loam		Source: NRCS
Surrounding Land Use: Forested Wetland		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) = 23.5

Justification / Notes: Stream within wetland area

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 12)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	3
2. Sinuous channel	0	1	2	3
3. In-channel structure: riffle-pool sequences	0	1	2	3
4. Sorting of soil textures or other substrate	0	1	2	3
5. Active/relic floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Braided channel	0	1	2	3
8. Recent alluvial deposits	0	0.5	1	1.5
9. Natural levees	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map	No = 0		Yes = 3	

B. Hydrology (Subtotal = 6.5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	1	2	3
15. Water in channel and >48 hours since sig. rain	0	1	2	3
N/A 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel	No = 0		Yes = 1.5	

C. Biology (Subtotal = 5)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	1	0
21. Rooted plants in channel [1]	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0.5	1	1.5
23. Bivalves/mussels	0	1	2	3
24. Amphibians	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	2	3
26. Filamentous algae; periphyton	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5
28. Wetland plants in channel [2]	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 23.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes:

Seq ID: 010

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: STR 5	Date/Time: 12/7/16 10:45am
Assessors/Affiliation: SBR/PSL Amy Foster Wheeler		Project ID :
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Borrow Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.380174 -87.675207
Previous Rainfall (7-days) : 1.14" NOAA Clarksville		
Precipitation this Season vs. Normal : very wet wet average (dry) drought unknown Source of recent & seasonal precip data : NOAA Clarksville		
Watershed Size : ± 60 acres	Photos: (Y) or N (circle) Number : 4	
Soil Type(s) / Geology : Lindell silt loam		Source: NRCS
Surrounding Land Use : Agriculture - pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	n/a	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	n/a	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)		(Stream)
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (If applicable) =

Justification / Notes : Stream runs along tree line - impacted by cattle.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	(3)
2. Sinuous channel	0	1	(2)	3
3. In-channel structure: riffle-pool sequences	0	1	(2)	3
4. Sorting of soil textures or other substrate	0	(1)	2	3
5. Active/relic floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	(1)	2	3
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	0	(0.5)	1	1.5
9. Natural levees	(0)	1	2	3
10. Headcuts	(0)	1	2	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	(0.5)	1	1.5
13. At least second order channel on existing USGS or NRCS map	(No = 0)		Yes = 3	

B. Hydrology (Subtotal = 2.5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	(1)	2	3
n/a 15. Water in channel and >48 hours since sig. rain	0	1	2	3
n/a 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	0	(0.5)	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	(1)	1.5
19. Hydric soils in stream bed or sides of channel	(No = 0)		Yes = 1.5	

C. Biology (Subtotal = 7)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	(3)	2	1	0
21. Rooted plants in channel [1]	(3)	2	1	0
22. Crayfish in stream (exclude in floodplain)	(0)	0.5	1	1.5
23. Bivalves/mussels	(0)	1	2	3
24. Amphibians	(0)	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	(1)	2	3
26. Filamentous algae; periphyton	(0)	1	2	3
27. Iron oxidizing bacteria/fungus	(0)	0.5	1	1.5
28. Wetland plants in channel [2]	(0)	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 20

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Seq ID: 011

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: STR-6	Date/Time: [illegible]
Assessors/Affiliation: SBR / TSL Anna Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Borrow Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.380813 -87.674886
Previous Rainfall (7-days): 1.14" NWA Clarksville, TN		
Precipitation this Season vs. Normal: very wet wet average dry drought unknown Source of recent & seasonal precip data:		
Watershed Size: ± 12 Acres	Photos: (Y) or N (circle) Number: 2	
Soil Type(s) / Geology: Lindell Silt loam		Source: NRCS
Surrounding Land Use: Agriculture - pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)		(Stream)
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water		Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Stream

Secondary Indicator Score (if applicable) =

Justification / Notes: Channel between ponds

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 9.5)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	(2)	3
2. Sinuous channel	0	1	(2)	3
3. In-channel structure: riffle-pool sequences	0	(1)	2	3
4. Sorting of soil textures or other substrate	0	(1)	2	3
5. Active/relic floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	(0)	0.5	1	1.5
9. Natural levees	(0)	1	2	3
10. Headcuts	0	1	(2)	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	0.5	(1)	1.5
13. At least second order channel on existing USGS or NRCS map	(No = 0)		Yes = 3	

B. Hydrology (Subtotal = 1.5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	(1)	2	3
NA 15. Water in channel and >48 hours since sig. rain	0	1	2	3
NA 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	(0)	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	(0.5)	1	1.5
19. Hydric soils in stream bed or sides of channel	(No = 0)		Yes = 1.5	

C. Biology (Subtotal = 9)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel[1]	(3)	2	1	0
21. Rooted plants in channel[1]	(3)	2	1	0
22. Crayfish in stream (exclude in floodplain)	(0)	0.5	1	1.5
23. Bivalves/mussels	(0)	1	2	3
24. Amphibians	(0)	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	(2)	3
26. Filamentous algae; periphyton	0	(1)	2	3
27. Iron oxidizing bacteria/fungus	(0)	0.5	1	1.5
28. Wetland plants in channel[2]	(0)	0.5	1	2

[1] Focus is on the presence of upland plants [2] Focus is on the presence of aquatic or wetland plants

Total Points = 20

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes: Mayflies observed

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

Named Waterbody:	Date/Time: 9/1/2021
Assessors/Affiliation: Zach Luttrell - TVA	Project ID : 536018
Site Name/Description: Seq ID: E001 (ASZ003)	
Site Location: TVA Cumberland Fossil Plant	
HUC (12 digit): 051302050403	Latitude: 36.379799
Previous Rainfall (7-days) : 3 inches, NOAA Clarksville	Longitude: -87.688364
Precipitation this Season vs. Normal : elevated Source of recent & seasonal precip. data :	
Watershed Size : 36,472 acres	County: Stewart
Soil Type(s) / Geology :	Source:
Surrounding Land Use : Rural	
Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight	

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	☐	WWC
2. Defined bed and bank absent, vegetation composed of upland and FACU species	☐	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A	☐	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	☐	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	☐	Stream
6. Presence of fish (except *Gambusia*)	☐	Stream
7. Presence of naturally occurring ground water table connection	☐	Stream
8. Flowing water in channel and 7 days since last precip >0.1" in local watershed	☐	Stream
9. Evidence watercourse has been used as a supply of drinking water	☐	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

Overall Hydrologic Determination = WET WEATHER CONVEYANCE

Secondary Indicator Score (if applicable) = 3.50

Justification / Notes :

Small amount of alluvial deposits

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 1.50)	Absent	Weak	Moderate	Strong	
1. Continuous bed and bank	0	1	2	3	0.5
2. Sinuous channel	0	1	2	3	0
3. In-channel structure: riffle-pool sequences	0	1	2	3	0
4. Sorting of soil textures or other substrate	0	1	2	3	0
5. Active/relic floodplain	0	0.5	1	1.5	0
6. Depositional bars or benches	0	1	2	3	0
7. Braided channel	0	1	2	3	0
8. Recent alluvial deposits	0	0.5	1	1.5	0.5
9. Natural levees	0	1	2	3	0
10. Headcuts	0	1	2	3	0
11. Grade controls	0	0.5	1	1.5	0
12. Natural valley or drainageway	0	0.5	1	1.5	0.5
13. At least second order channel on existing USGS or NRCS map	0	1	2	3	0

B. Hydrology (Subtotal = 2.00)	Absent	Weak	Moderate	Strong	
14. Subsurface flow/discharge into channel	0	1	2	3	1.5
15. Water in channel and >48 hours since sig. rain	0	1	2	3	0
16. Leaf litter in channel	1.5	1	0.5	0	0.5
17. Sediment on plants or on debris	0	0.5	1	1.5	0
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5	0
19. Hydric soils in channel bed or sides of channel	No = 0		Yes = 1.5		0

C. Biology (Subtotal = 0.00)	Absent	Weak	Moderate	Strong	
20. Fibrous roots in channel bed [1]	3	2	1	0	0
21. Rooted plants in the thalweg [1]	3	2	1	0	0
22. Crayfish in stream (exclude in floodplain)	0	1	2	3	0
23. Bivalves/mussels	0	1	2	3	0
24. Amphibians	0	0.5	1	1.5	0
25. Macrobenthos (record type & abundance)	0	1	2	3	0
26. Filamentous algae; periphyton	0	1	2	3	0
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5	0
28. Wetland plants in channel bed [2]	0	0.5	1	1.5	0

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 3.50

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

Named Waterbody:	Date/Time: 9/1/2021
Assessors/Affiliation: Zach Luttrell - TVA	Project ID : 536018
Site Name/Description: Seq ID: E002 (ASZ004)	
Site Location: TVA Cumberland Fossil Plant	
HUC (12 digit): 051302050403	Latitude: 36.380032
Previous Rainfall (7-days) : 3 inches, NOAA Clarksville	Longitude: -87.686806
Precipitation this Season vs. Normal : elevated Source of recent & seasonal precip. data :	
Watershed Size : 36,472 acres	County: Stewart
Soil Type(s) / Geology :	Source:
Surrounding Land Use : Rural	
Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight	

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge		WWC
2. Defined bed and bank absent, vegetation composed of upland and FACU species		WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A		WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall		WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase		Stream
6. Presence of fish (except *Gambusia*)		Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precip >0.1" in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water		Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

Overall Hydrologic Determination = WET WEATHER CONVEYANCE

Secondary Indicator Score (if applicable) = 4.50

Justification / Notes :

Small amount of alluvial deposits in steep ravine.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 3.00)	Absent	Weak	Moderate	Strong	
1. Continuous bed and bank	0	1	2	3	1
2. Sinuous channel	0	1	2	3	0.5
3. In-channel structure: riffle-pool sequences	0	1	2	3	0
4. Sorting of soil textures or other substrate	0	1	2	3	0
5. Active/relic floodplain	0	0.5	1	1.5	0
6. Depositional bars or benches	0	1	2	3	0
7. Braided channel	0	1	2	3	0
8. Recent alluvial deposits	0	0.5	1	1.5	0.5
9. Natural levees	0	1	2	3	0
10. Headcuts	0	1	2	3	0
11. Grade controls	0	0.5	1	1.5	0.5
12. Natural valley or drainageway	0	0.5	1	1.5	0.5
13. At least second order channel on existing USGS or NRCS map	0	1	2	3	0

B. Hydrology (Subtotal = 1.50)	Absent	Weak	Moderate	Strong	
14. Subsurface flow/discharge into channel	0	1	2	3	1
15. Water in channel and >48 hours since sig. rain	0	1	2	3	0
16. Leaf litter in channel	1.5	1	0.5	0	0
17. Sediment on plants or on debris	0	0.5	1	1.5	0.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5	0
19. Hydric soils in channel bed or sides of channel	No = 0		Yes = 1.5		0

C. Biology (Subtotal = 0.00)	Absent	Weak	Moderate	Strong	
20. Fibrous roots in channel bed [1]	3	2	1	0	0
21. Rooted plants in the thalweg [1]	3	2	1	0	0
22. Crayfish in stream (exclude in floodplain)	0	1	2	3	0
23. Bivalves/mussels	0	1	2	3	0
24. Amphibians	0	0.5	1	1.5	0
25. Macrobenthos (record type & abundance)	0	1	2	3	0
26. Filamentous algae; periphyton	0	1	2	3	0
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5	0
28. Wetland plants in channel bed [2]	0	0.5	1	1.5	0

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 4.50

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor, Nashville, TN 37243

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

Named Waterbody:	Date/Time: 9/1/2021
Assessors/Affiliation: Zach Luttrell - TVA	Project ID : 536018
Site Name/Description: Seq ID: E003 (ASZ005)	
Site Location: TVA Cumberland Fossil Plant	
HUC (12 digit): 051302050403	Latitude: 36.381736
Previous Rainfall (7-days) : 3 inches, NOAA Clarksville	Longitude: -87.688405
Precipitation this Season vs. Normal : elevated Source of recent & seasonal precip. data :	
Watershed Size : 36,472 acres	County: Stewart
Soil Type(s) / Geology :	Source:
Surrounding Land Use : Rural	
Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight	

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge		WWC
2. Defined bed and bank absent, vegetation composed of upland and FACU species		WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A		WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall		WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase		Stream
6. Presence of fish (except *Gambusia*)		Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precip >0.1" in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water		Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

Overall Hydrologic Determination = WET WEATHER CONVEYANCE

Secondary Indicator Score (if applicable) = 10.50

Justification / Notes :

sorting, root grade controls, moderate bed and bank

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 7.50)	Absent	Weak	Moderate	Strong	
1. Continuous bed and bank	0	1	2	3	2
2. Sinuous channel	0	1	2	3	0
3. In-channel structure: riffle-pool sequences	0	1	2	3	1
4. Sorting of soil textures or other substrate	0	1	2	3	2
5. Active/relic floodplain	0	0.5	1	1.5	0
6. Depositional bars or benches	0	1	2	3	0
7. Braided channel	0	1	2	3	0
8. Recent alluvial deposits	0	0.5	1	1.5	0
9. Natural levees	0	1	2	3	0
10. Headcuts	0	1	2	3	1
11. Grade controls	0	0.5	1	1.5	0.5
12. Natural valley or drainageway	0	0.5	1	1.5	1
13. At least second order channel on existing USGS or NRCS map	0	1	2	3	0

B. Hydrology (Subtotal = 2.00)	Absent	Weak	Moderate	Strong	
14. Subsurface flow/discharge into channel	0	1	2	3	1
15. Water in channel and >48 hours since sig. rain	0	1	2	3	0
16. Leaf litter in channel	1.5	1	0.5	0	0.5
17. Sediment on plants or on debris	0	0.5	1	1.5	0.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5	0
19. Hydric soils in channel bed or sides of channel	No = 0		Yes = 1.5		0

C. Biology (Subtotal = 1.00)	Absent	Weak	Moderate	Strong	
20. Fibrous roots in channel bed [1]	3	2	1	0	1
21. Rooted plants in the thalweg [1]	3	2	1	0	0
22. Crayfish in stream (exclude in floodplain)	0	1	2	3	0
23. Bivalves/mussels	0	1	2	3	0
24. Amphibians	0	0.5	1	1.5	0
25. Macrobenthos (record type & abundance)	0	1	2	3	0
26. Filamentous algae; periphyton	0	1	2	3	0
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5	0
28. Wetland plants in channel bed [2]	0	0.5	1	1.5	0

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 10.50

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Tennessee Department of Environment and Conservation - Division of Water Resources
312 Rosa L. Parks Ave. 11th Floor. Nashville, TN 37243

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Resources, Version 1.5 (Fillable Form)

Named Waterbody:	Date/Time: 9/1/2021
Assessors/Affiliation: Zach Luttrell - TVA	Project ID : 536018
Site Name/Description: Seq ID: E004 (ASZ006)	
Site Location: TVA Cumberland Fossil Plant	
HUC (12 digit): 051302050403	Latitude: 36.384226
Previous Rainfall (7-days) : 3 inches, NOAA Clarksville	Longitude: -87.688042
Precipitation this Season vs. Normal : elevated Source of recent & seasonal precip. data :	
Watershed Size : 36,472 acres	County: Stewart
Soil Type(s) / Geology :	Source:
Surrounding Land Use : Rural	
Degree of historical alteration to natural channel morphology & hydrology (select one & describe fully in Notes) : Slight	

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	☐	WWC
2. Defined bed and bank absent, vegetation composed of upland and FACU species	☐	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions N/A	☐	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	☐	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	☐	Stream
6. Presence of fish (except *Gambusia*)	☐	Stream
7. Presence of naturally occurring ground water table connection	☐	Stream
8. Flowing water in channel and 7 days since last precip >0.1" in local watershed	☐	Stream
9. Evidence watercourse has been used as a supply of drinking water	☐	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then no further investigation is necessary. However, assessors may choose to score secondary indicators as supporting evidence.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-DWR Guidance For Making Hydrologic Determinations, Version 1.5*

Overall Hydrologic Determination = WET WEATHER CONVEYANCE

Secondary Indicator Score (if applicable) = 6.00

Justification / Notes :

Steep ravine with noticable WWC features

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 4.00)	Absent	Weak	Moderate	Strong	
1. Continuous bed and bank	0	1	2	3	1
2. Sinuous channel	0	1	2	3	0.5
3. In-channel structure: riffle-pool sequences	0	1	2	3	0
4. Sorting of soil textures or other substrate	0	1	2	3	0
5. Active/relic floodplain	0	0.5	1	1.5	0
6. Depositional bars or benches	0	1	2	3	0
7. Braided channel	0	1	2	3	0
8. Recent alluvial deposits	0	0.5	1	1.5	0.5
9. Natural levees	0	1	2	3	0
10. Headcuts	0	1	2	3	0
11. Grade controls	0	0.5	1	1.5	1
12. Natural valley or drainageway	0	0.5	1	1.5	1
13. At least second order channel on existing USGS or NRCS map	0	1	2	3	0

B. Hydrology (Subtotal = 2.00)	Absent	Weak	Moderate	Strong	
14. Subsurface flow/discharge into channel	0	1	2	3	1
15. Water in channel and >48 hours since sig. rain	0	1	2	3	0
16. Leaf litter in channel	1.5	1	0.5	0	0.5
17. Sediment on plants or on debris	0	0.5	1	1.5	0
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5	0.5
19. Hydric soils in channel bed or sides of channel	No = 0		Yes = 1.5		0

C. Biology (Subtotal = 0.00)	Absent	Weak	Moderate	Strong	
20. Fibrous roots in channel bed [1]	3	2	1	0	0
21. Rooted plants in the thalweg [1]	3	2	1	0	0
22. Crayfish in stream (exclude in floodplain)	0	1	2	3	0
23. Bivalves/mussels	0	1	2	3	0
24. Amphibians	0	0.5	1	1.5	0
25. Macrobenthos (record type & abundance)	0	1	2	3	0
26. Filamentous algae; periphyton	0	1	2	3	0
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5	0
28. Wetland plants in channel bed [2]	0	0.5	1	1.5	0

[1] Focus is on the presence of terrestrial plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 6.00

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Seq ID: E005

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: WW C9	Date/Time: 12/7/16 9:20AM
Assessors/Affiliation: SBR/PSG Ama Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Barrow Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.383445 -87.672059
Previous Rainfall (7-days): 1.45" NOAA Clarksville, TN		
Precipitation this Season vs. Normal: very wet wet average dry drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: 1.18 acres	Photos: (Y) or N (circle) Number: 2	
Soil Type(s) / Geology: Lindell Silt loam		Source: NRCS
Surrounding Land Use: Agriculture - Pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe (Moderate) Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 10.5

Justification / Notes: Feature runs along tree line - impacted by cattle.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 6)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	(2)	3
2. Sinuous channel	0	(1)	2	3
3. In-channel structure: riffle-pool sequences	0	(1)	2	3
4. Sorting of soil textures or other substrate	(0)	1	2	3
5. Active/relic floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	(0)	0.5	1	1.5
9. Natural levees	(0)	1	2	3
10. Headcuts	0	(1)	2	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	(0.5)	1	1.5
13. At least second order channel on existing USGS or NRCS map	(No = 0)		Yes = 3	

B. Hydrology (Subtotal = 0.5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	(0)	1	2	3
NA 15. Water in channel and >48 hours since sig. rain	0	1	2	3
NA 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	(0)	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	(0.5)	1	1.5
19. Hydric soils in stream bed or sides of channel	(No = 0)		Yes = 1.5	

C. Biology (Subtotal = 4)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	(2)	1	0
21. Rooted plants in channel [1]	3	(2)	1	0
22. Crayfish in stream (exclude in floodplain)	(0)	0.5	1	1.5
23. Bivalves/mussels	(0)	1	2	3
24. Amphibians	(0)	0.5	1	1.5
25. Macrobenthos (record type & abundance)	(0)	1	2	3
26. Filamentous algae; periphyton	(0)	1	2	3
27. Iron oxidizing bacteria/fungus	(0)	0.5	1	1.5
28. Wetland plants in channel [2]	(0)	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 10.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes:

Seq ID: E006

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: WWC-8	Date/Time: 12/2 1:22pm
Assessors/Affiliation: SBR / FSL Amec Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed bank fill Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.384126 -87.679547
Previous Rainfall (7-days): 1.32' NOAA Clarksville, TN		
Precipitation this Season vs. Normal: very wet wet average (dry) drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: ± 30 acres	Photos: (Y) or N (circle) Number: 2	
Soil Type(s) / Geology: Burline & Lobelville silt loams		Source: NRCS
Surrounding Land Use: Forested / previously logged		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge		WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass		WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase		Stream
6. Presence of fish (except *Gambusia*)		Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water		Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 12.5

Justification / Notes: Wet weather conveyance, lower reach filled in with bull dozed tree tops

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 9)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	(2)	3
2. Sinuous channel	0	(1)	2	3
3. In-channel structure: riffle-pool sequences	0	(1)	2	3
4. Sorting of soil textures or other substrate	0	(1)	2	3
5. Active/relic floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Braided channel	0	(1)	2	3
8. Recent alluvial deposits	0	(0.5)	1	1.5
9. Natural levees	(0)	1	2	3
10. Headcuts	0	(1)	2	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	0.5	(1)	1.5
13. At least second order channel on existing USGS or NRCS map	(No = 0)		Yes = 3	

B. Hydrology (Subtotal = 5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	(0)	1	2	3
15. Water in channel and >48 hours since sig. rain	(0)	1	2	3
16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	(0)	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	(0.5)	1	1.5
19. Hydric soils in stream bed or sides of channel	(No = 0)		Yes = 1.5	

C. Biology (Subtotal = 3)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	(1)	0
21. Rooted plants in channel [1]	3	(2)	1	0
22. Crayfish in stream (exclude in floodplain)	(0)	0.5	1	1.5
23. Bivalves/mussels	(0)	1	2	3
24. Amphibians	(0)	0.5	1	1.5
25. Macrobenthos (record type & abundance)	(0)	1	2	3
26. Filamentous algae; periphyton	(0)	1	2	3
27. Iron oxidizing bacteria/fungus	(0)	0.5	1	1.5
28. Wetland plants in channel [2]	(0)	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 12.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes:

Seq ID: E007

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: WWC 11	Date/Time: 2/7/ 12:00 Am
Assessors/Affiliation: SBR / FSL Amec Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Borrow Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.379486 -87.676195
Previous Rainfall (7-days): 1.14" NOAA Clarksville, TN		
Precipitation this Season vs. Normal: very wet wet average dry drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: ± 12 Acres	Photos: (Y) or N (circle) Number: 2	
Soil Type(s) / Geology: Lindell silt loam		Source: NRCS
Surrounding Land Use: Agriculture - pasture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	NA	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	NA	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 11

Justification / Notes: - Ditch along tree line - Impacted by cattle

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 9.5)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	(2)	3
2. Sinuous channel	0	1	(2)	3
3. In-channel structure: riffle-pool sequences	0	(1)	2	3
4. Sorting of soil textures or other substrate	0	(1)	2	3
5. Active/relic floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Braided channel	0	(1)	2	3
8. Recent alluvial deposits	(0)	0.5	1	1.5
9. Natural levees	(0)	1	2	3
10. Headcuts	0	(1)	2	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	0.5	(1)	1.5
13. At least second order channel on existing USGS or NRCS map	No = 0		Yes = 3	

B. Hydrology (Subtotal = 1.5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	(0)	1	2	3
NA 15. Water in channel and >48 hours since sig. rain	0	1	2	3
NA 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	0	(0.5)	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	(1)	1.5
19. Hydric soils in stream bed or sides of channel	(No = 0)		Yes = 1.5	

C. Biology (Subtotal = 5)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	(2)	1	0
21. Rooted plants in channel [1]	(3)	2	1	0
22. Crayfish in stream (exclude in floodplain)	(0)	0.5	1	1.5
23. Bivalves/mussels	0	1	2	3
24. Amphibians	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	2	3
26. Filamentous algae; periphyton	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5
28. Wetland plants in channel [2]	(0)	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 16

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes:

Seq ID: E008

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: WWC 6	Date/Time: 12/7/12 11:23am
Assessors/Affiliation: SBR / TSK Amec Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Landfill Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.37723 -87.685735
Previous Rainfall (7-days): 1.32" NOAA Clarksville		
Precipitation this Season vs. Normal: very wet wet average (dry) drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: ± 270 acres	Photos: (Y) or N (circle) Number: 4	
Soil Type(s) / Geology: Bodine gravelly silt loam & Lobelville silt loam Source: NRCS		
Surrounding Land Use: Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge		WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass		WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N	A WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N	A WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase		Stream
6. Presence of fish (except *Gambusia*)		Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water		Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 12.5

Justification / Notes: Possible alteration due to logging operation

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 9)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	(2)	3
2. Sinuous channel	0	(1)	2	3
3. In-channel structure: riffle-pool sequences	0	(1)	2	3
4. Sorting of soil textures or other substrate	0	1	(2)	3
5. Active/relic floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Braided channel	0	(1)	2	3
8. Recent alluvial deposits	(0)	0.5	1	1.5
9. Natural levees	(0)	1	2	3
10. Headcuts	(0)	1	2	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	0.5	1	(1.5)
13. At least second order channel on existing USGS or NRCS map	No = 0		Yes = 3	

B. Hydrology (Subtotal = 0.5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	(0)	1	2	3
15. Water in channel and >48 hours since sig. rain	(0)	1	2	3
16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	(0)	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	(0.5)	1	1.5
19. Hydric soils in stream bed or sides of channel	No = 0		Yes = 1.5	

NA

C. Biology (Subtotal = 3)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	(1)	0
21. Rooted plants in channel [1]	3	(2)	1	0
22. Crayfish in stream (exclude in floodplain)	(0)	0.5	1	1.5
23. Bivalves/mussels	(0)	1	2	3
24. Amphibians	(0)	0.5	1	1.5
25. Macrobenthos (record type & abundance)	(0)	1	2	3
26. Filamentous algae; periphyton	(0)	1	2	3
27. Iron oxidizing bacteria/fungus	(0)	0.5	1	1.5
28. Wetland plants in channel [2]	(0)	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 12.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes:

Seq ID: E009

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: WWC 5	Date/Time: 12/2 16:02
Assessors/Affiliation: SBR/ABL Anna Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Landfill Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.375533 -87.682051
Previous Rainfall (7-days): 1.32" NOAA Clarksville, TN		
Precipitation this Season vs. Normal: very wet wet average (dry) drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: ± 160 acres	Photos: (Y) or N (circle) Number: 3	
Soil Type(s) / Geology: Bodine gravelly silt loam		Source: NRCS
Surrounding Land Use: Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge		WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass		WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase		Stream
6. Presence of fish (except *Gambusia*)		Stream
7. Presence of naturally occurring ground water table connection		Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed		Stream
9. Evidence watercourse has been used as a supply of drinking water		Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conv Valley

Secondary Indicator Score (if applicable) = 13.5

Justification / Notes: May have been historically altered by logging activities

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 9)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	(3)
2. Sinuous channel	0	(1)	2	3
3. In-channel structure: riffle-pool sequences	0	(1)	2	3
4. Sorting of soil textures or other substrate	0	(1)	2	3
5. Active/relic floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	(0)	0.5	1	1.5
9. Natural levees	(0)	1	2	3
10. Headcuts	0	(1)	2	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	0.5	1	(1.5)
13. At least second order channel on existing USGS or NRCS map	No = (0)		Yes = 3	

B. Hydrology (Subtotal = 0.5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	(0)	1	2	3
15. Water in channel and >48 hours since sig. rain	(0)	1	2	3
16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	(0)	(0.5)	1	1.5
18. Organic debris lines or piles (wrack lines)	(0)	(0.5)	1	1.5
19. Hydric soils in stream bed or sides of channel	No = 0		Yes = 1.5	

C. Biology (Subtotal = 4)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	(1)	0
21. Rooted plants in channel [1]	(3)	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0.5	1	1.5
23. Bivalves/mussels	0	1	2	3
24. Amphibians	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	2	3
26. Filamentous algae; periphyton	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5
28. Wetland plants in channel [2]	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 13.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes:

Seq ID: E010

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: WWL-7	Date/Time: 12/2 11:38pm
Assessors/Affiliation: SBR/BLr		Project ID :
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Landfill Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.378499 -87.683406
Previous Rainfall (7-days) : 1.32"	NOAA Clarksville, TN	
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : NOAA Clarksville		
Watershed Size : ≈ 80 acres	Photos (Y or N (circle) Number : 3	
Soil Type(s) / Geology : Baxline gravelly silt loam		Source: NRCS
Surrounding Land Use : Forested		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) = 11.0

Justification / Notes : May have been altered during logging operations.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 8)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	3
2. Sinuous channel	0	1	2	3
3. In-channel structure: riffle-pool sequences	0	1	2	3
4. Sorting of soil textures or other substrate	0	1	2	3
5. Active/relic floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Braided channel	0	1	2	3
8. Recent alluvial deposits	0	0.5	1	1.5
9. Natural levees	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map	No = 0		Yes = 3	

B. Hydrology (Subtotal = 0)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	1	2	3
15. Water in channel and >48 hours since sig. rain	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel	No = 0		Yes = 1.5	

N/a

C. Biology (Subtotal = 3)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	1	0
21. Rooted plants in channel [1]	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0.5	1	1.5
23. Bivalves/mussels	0	1	2	3
24. Amphibians	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	2	3
26. Filamentous algae; periphyton	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5
28. Wetland plants in channel [2]	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 11

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Seq ID: E011

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: Mine WWC 2	Date/Time: 11/30/16 11:30am
Assessors/Affiliation: SBR, BG Anna Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Borrow Area		
USGS quad: Erin	HUC (12 digit): 051302050402	Lat/Long: 36.334497 -87.673961
Previous Rainfall (7-days): 1.36" NOAA Clarksville, TN		
Precipitation this Season vs. Normal: very wet wet average dry drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: 1.15 acres	Photos: (Y) or N (circle) Number: 4	
Soil Type(s) / Geology: Nolin, Sengtown, Mixing Silt Loam		Source: NRCS
Surrounding Land Use: Pasture, Agriculture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe (Moderate) Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) =

Justification / Notes: Dissipates into wetland

Channel has been altered by cattle.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 8.5)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	(3)
2. Sinuous channel	0	(1)	2	3
3. In-channel structure: riffle-pool sequences	0	(1)	2	3
4. Sorting of soil textures or other substrate	0	(1)	2	3
5. Active/relic floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	(0)	0.5	1	1.5
9. Natural levees	(0)	1	2	3
10. Headcuts	0	(1)	2	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	0.5	(1)	1.5
13. At least second order channel on existing USGS or NRCS map	(No = 0)		Yes = 3	

B. Hydrology (Subtotal = 0.5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	(0)	1	2	3
15. Water in channel and >48 hours since sig. rain	(0)	1	2	3
N/A 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	(0)	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	(0.5)	1	1.5
19. Hydric soils in stream bed or sides of channel	(No = 0)		Yes = 1.5	

C. Biology (Subtotal = 4)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	(3)	2	1	0
21. Rooted plants in channel [1]	3	2	(1)	0
22. Crayfish in stream (exclude in floodplain)	(0)	0.5	1	1.5
23. Bivalves/mussels	(0)	1	2	3
24. Amphibians	(0)	0.5	1	1.5
25. Macrobenthos (record type & abundance)	(0)	1	2	3
26. Filamentous algae; periphyton	(0)	1	2	3
27. Iron oxidizing bacteria/fungus	(0)	0.5	1	1.5
28. Wetland plants in channel [2]	(0)	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 13

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes:

Seq ID: E012

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: None WWC-1	Date/Time: 11/30/16 11:00am
Assessors/Affiliation: SBL/FSL Ama Foster Wheeler		Project ID :
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Borrow Area		
USGS quad: Erin	HUC (12 digit): 051302050402	Lat/Long: 36.375062 -87.674017
Previous Rainfall (7-days) : 1.36' NOAA Clarksville, TN		
Precipitation this Season vs. Normal : very wet wet average dry drought unknown Source of recent & seasonal precip data : NOAA Clarksville		
Watershed Size : ± 60 Acres	Photos: Y or N (circle) Number : +5	
Soil Type(s) / Geology : Byler, Sanstown, Nolin Silt loam		Source: NRCS
Surrounding Land Use : Pasture / Agriculture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather conveyance

Secondary Indicator Score (if applicable) =

Justification / Notes : Dissapates into wetland

Channel has been altered by cattle.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 11)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	3
2. Sinuous channel	0	1	2	3
3. In-channel structure: riffle-pool sequences	0	1	2	3
4. Sorting of soil textures or other substrate	0	1	2	3
5. Active/relic floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Braided channel	0	1	2	3
8. Recent alluvial deposits	0	0.5	1	1.5
9. Natural levees	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map	No = 0		Yes = 3	

B. Hydrology (Subtotal = 1)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	1	2	3
15. Water in channel and >48 hours since sig. rain	0	1	2	3
NA 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel	No = 0		Yes = 1.5	

C. Biology (Subtotal = 4)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	1	0
21. Rooted plants in channel [1]	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0.5	1	1.5
23. Bivalves/mussels	0	1	2	3
24. Amphibians	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	2	3
26. Filamentous algae; periphyton	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5
28. Wetland plants in channel [2]	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 16

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

Seq ID: E013

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: Nine WWC-3	Date/Time: 11/3/2016 12:34pm
Assessors/Affiliation: SBR/BL Anna Foster Wheeler		Project ID:
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Borrow Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.379867 -87.670523
Previous Rainfall (7-days): 1.36" NOAA Clarksville, TN		
Precipitation this Season vs. Normal: very wet wet average dry drought unknown Source of recent & seasonal precip data: NOAA Clarksville		
Watershed Size: < 3 acres	Photos: (Y) or N (circle) Number: 3	
Soil Type(s) / Geology: Lindell silt loam		Source: NRCS
Surrounding Land Use: Pasture / Agriculture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): Severe Moderate (Slight) Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE: If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) =

Justification / Notes: Dissipates into wetland

channel altered by cattle.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 4)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	3
2. Sinuous channel	0	1	2	3
3. In-channel structure: riffle-pool sequences	0	1	2	3
4. Sorting of soil textures or other substrate	0	1	2	3
5. Active/relic floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Braided channel	0	1	2	3
8. Recent alluvial deposits	0	0.5	1	1.5
9. Natural levees	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map	No = 0		Yes = 3	

B. Hydrology (Subtotal = 0.5)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	1	2	3
15. Water in channel and >48 hours since sig. rain	0	1	2	3
N/A 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel	No = 0		Yes = 1.5	

C. Biology (Subtotal = 2)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	1	0
21. Rooted plants in channel [1]	3	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0.5	1	1.5
23. Bivalves/mussels	0	1	2	3
24. Amphibians	0	0.5	1	1.5
25. Macrobenthos (record type & abundance)	0	1	2	3
26. Filamentous algae; periphyton	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5
28. Wetland plants in channel [2]	0	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 6.5

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes:

Seq ID: E014

Hydrologic Determination Field Data Sheet

Tennessee Division of Water Pollution Control, Version 1.4

County: Stewart	Named Waterbody: Nerve WWC-4	Date/Time: 11/30/12 2:30 pm
Assessors/Affiliation: SBR/BL- Anna Foster Wheeler		Project ID :
Site Name/Description: TVA Cumberland Fossil Plant		
Site Location: Proposed Borrow Area		
USGS quad: Cumberland City	HUC (12 digit): 051302050402	Lat/Long: 36.378111 -87.673982
Previous Rainfall (7-days) : 1.36" NOAA Clarksville, TN		
Precipitation this Season vs. Normal : very wet wet average (circle) dry drought unknown Source of recent & seasonal precip data : NOAA Clarksville		
Watershed Size : 1.40 acres	Photos: (Y) or N (circle) Number : 15	
Soil Type(s) / Geology : Lindell, Humphreys, Baxter silt loam		Source: NRCS
Surrounding Land Use : Pasture/Agriculture		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) : Severe Moderate Slight Absent		

Primary Field Indicators Observed

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	N/A	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	N/A	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except *Gambusia*)	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	✓	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

Overall Hydrologic Determination = Wet Weather Conveyance

Secondary Indicator Score (if applicable) =

Justification / Notes : Dissipates into wetland.

Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 11)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	(3)
2. Sinuous channel	0	1	(2)	3
3. In-channel structure: riffle-pool sequences	0	(1)	2	3
4. Sorting of soil textures or other substrate	0	(1)	2	3
5. Active/relic floodplain	(0)	1	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Braided channel	(0)	1	2	3
8. Recent alluvial deposits	0	(0.5)	1	1.5
9. Natural levees	(0)	1	2	3
10. Headcuts	0	(1)	2	3
11. Grade controls	0	(0.5)	1	1.5
12. Natural valley or drainageway	0	0.5	(1)	1.5
13. At least second order channel on existing USGS or NRCS map	(No) = 0		Yes = 3	

B. Hydrology (Subtotal = 1)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	(0)	1	2	3
15. Water in channel and >48 hours since sig. rain	(0)	1	2	3
N/A 16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	(0)	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	(1)	1.5
19. Hydric soils in stream bed or sides of channel	(No) = 0		Yes = 1.5	

C. Biology (Subtotal = 3)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel [1]	3	2	(1)	0
21. Rooted plants in channel [1]	(3)	2	1	0
22. Crayfish in stream (exclude in floodplain)	(0)	0.5	1	1.5
23. Bivalves/mussels	(0)	1	2	3
24. Amphibians	(0)	0.5	1	1.5
25. Macrobenthos (record type & abundance)	(0)	1	2	3
26. Filamentous algae; periphyton	(0)	1	2	3
27. Iron oxidizing bacteria/fungus	(0)	0.5	1	1.5
28. Wetland plants in channel [2]	(0)	0.5	1	2

[1] Focus is on the presence of upland plants. [2] Focus is on the presence of aquatic or wetland plants.

Total Points = 16

Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points

Notes :

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
Nashville Environmental Field Office
711 R.S. Gass Boulevard
Nashville, TN 37216
Phone 615-687-7000 Statewide 1-888-891-8332 Fax 615-687-7078

August 12, 2022

Mike Stiefel
TVA - Water Permitting and Compliance
1101 Market Street – BR 4 A
Chattanooga, TN 37402

Re: Hydrologic Determination (DWR ID No. 31299)
TVA - Cumberland Fossil Plant

Dear Landowner:

On April 4, 2022, the Division of Water Resources (division) received a jurisdictional waters report submitted on your behalf by Britta Lees and AMEC Foster Wheeler. These water features are located on property located at 36.380174, -87.675207 (Lat/Long), in Cumberland City, Stewart County, Tennessee. Please note that all geographic coordinates provided in this letter have a limited precision and should be considered approximate.

This report was submitted in order to update a portion of a property for which a previous jurisdictional waters report was accepted by the division in 2017 (HD DWR ID #8753). Except for one additional wetland identified by the 2022 site visit, the other jurisdictional determinations remained the same in the updated report. After reviewing the updated data, as well aerial imagery of surrounding land use since the initial 2017 report, the division has determined that there is no reason to infer that the jurisdictional status of the water features in question has changed since 2017. Please see the attached map and table for a summary of the jurisdictional determinations for the water features on site.

Alterations to streams, wetlands, or other waters may only be performed under the coverage of, and conformance to, a valid *Aquatic Resource Alteration Permit (ARAP)* issued by the division, except where authorized by Rule. ARAP applications and provisions are available on-line at http://www.tn.gov/environment/article/permit-water-aquatic-resource-alteration-permit.

Any alterations to wet weather conveyances must be made in accordance with the requirements of Tenn. Code Ann. § 69-3-108(q).

Hydrologic determinations are advised and governed by Tennessee Department of Environment and Conservation (TDEC) rules and regulations, and therefore only apply to the State's permitting process. Because these and other various water features on-site may potentially also be considered jurisdictional Waters of the United States, any alterations to them should only be performed after consultation with the U.S. Army Corps of Engineers.

If the disturbed area of this project is one acre or greater, coverage under the *General NPDES Permit for Stormwater Discharges from Construction Activities (CGP)* will be required from this division before any clearing or earth moving activities are started. Information on the construction stormwater permit is available online at http://www.tn.gov/environment/article/permit-water-npdes-stormwater-construction-permit.

I appreciate the opportunity to assess the water features on site prior to site plan finalization and initiation of construction activities. Because natural variation and human activities can alter hydrologic conditions, the division reserves the right to reassess the status of the water features in the future.

Thank you for your interest in water quality in Tennessee. If you have any questions or need additional information, please contact me at 615-767-1430 or by email at Brooke.Heriges@tn.gov.

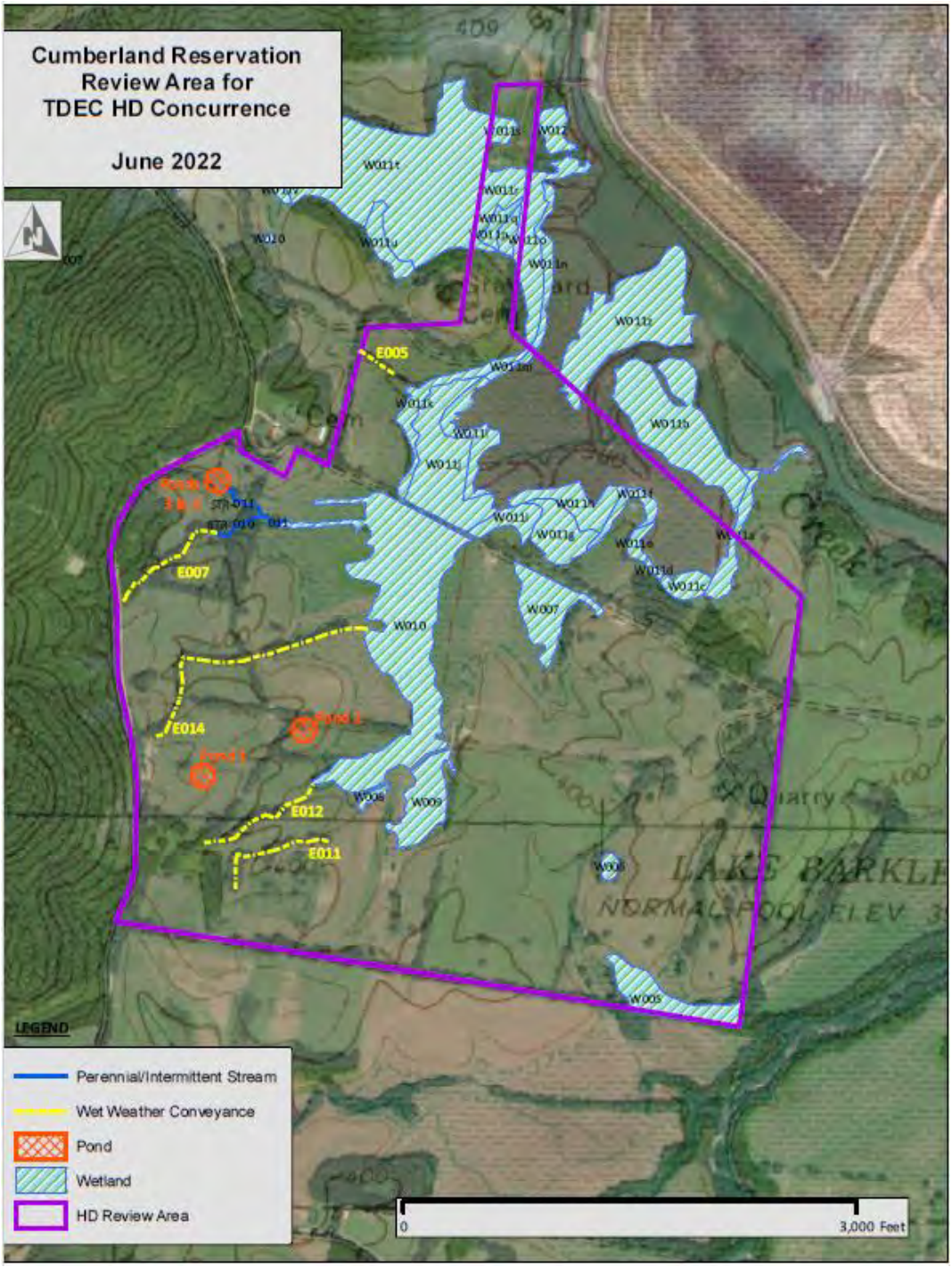
Sincerely,

Division of Water Resources

cc:

U.S. Army Corp of Engineers, NashvilleRegulatory@usace.army.mil
Britta Lees, bpdimick@tva.gov

Features	Classification	Start (Lat/Long)	End (Lat/Long)
E005	WWC	36.383508 -87.672463	36.383135 -87.671500
E007	WWC	36.378945 -87.677534	36.380218 -87.675455
E011	WWC	36.373744 -87.674893	36.374632 -87.672754
E012	WWC	36.374578 -87.675672	36.375690 -87.673186
E014	WWC	36.376513 -87.676806	36.378565 -87.671297
STR-010	Stream	36.380204 -87.675478	36.380401 -87.674223
STR-011	Stream	36.380986 -87.675247	36.380427 -87.673804
W005	Wetland	36.371912 -87.665131	--
W006	Wetland	36.374288 -87.666496	--
W007	Wetland	36.379226 87.667498	--
W008	Wetland	36.375482 -87.671862	--
W009	Wetland	36.375129 -87.670727	--
W010	Wetland	36.376980 -87.670543	--
W011a-s	Wetland	36.381321 -87.670396	--
Pond 1	Not waters of the state	36.375686 -87.675712	--
Pond 2	Not waters of the state	36.376542 -87.673370	--
Pond 3	Not waters of the state	36.380988 -87.675278	--
Pond 4	Not waters of the state	36.380735 -87.674819	--


Cumberland Reservation
Review Area for
TDEC HD Concurrence
June 2022
E005
E007
E014
E012
E011
W010
W007
W005
LEGEND
Perennial/Intermittent Stream
Wet Weather Conveyance
Pond
Wetland
HD Review Area
0
3,000 Feet

From:	Pilakowski, Ashley Anne
To:	Huddleston, Misty
Subject:	FW: TDEC HD CONCURRENCE -- FW: TVA-Cumberland Fossil Plant HD DWR ID #31299
Date:	Thursday, August 18, 2022 3:58:09 PM
Attachments:	image001.png image002.png Acceptance Letter.pdf WWC-HIGHLIGHT-TCA_69_3_108.pdf

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CAUTION: [EXTERNAL] This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

FYI -

From: Lees, Britta Paule <bpdimick@tva.gov>
Sent: Friday, August 12, 2022 3:57 PM
To: Willard, Emily P <epwillard@tva.gov>; Pilakowski, Ashley Anne <aapilakowski@tva.gov>; Melton, Joseph E <jemelton@tva.gov>; Pearman, Paul Jonathan <pjpearman@tva.gov>; Mehta, Khurshid K <kkmehta@tva.gov>; Johnson, Steven R <srjohnson4@tva.gov>
Cc: Reed, Matthew Philip <mpreed@tva.gov>; Buecker, Zachary D <zdbuecker@tva.gov>; Parker Hutcheon, Fallon Chambers <fcparkerhutcheon@tva.gov>
Subject: TDEC HD CONCURRENCE -- FW: TVA-Cumberland Fossil Plant HD DWR ID #31299

TDEC has provided HD concurrence for the aquatic features on the Cumberland Reservation located in the review area footprint for the potential gas plant and associated infrastructure.

This updated concurrence substantiates the previous 2017 concurrence, retaining the wet-weather-conveyance status for drainage features located within the current potential impact footprint. This HD concurrence also continues exclusion of the ponds from jurisdiction, but asserts State jurisdiction over W006; however, W006 is located outside the current potential impact footprint.

The HD concurrence means no TDEC/ARAP permitting is required for impacts to the ponds. Impacts to the wet-weather-conveyances on site can proceed without TDEC/ARAP permitting if proposed activities continue to meet the conditions of Section 69-3-108(q) (attached, highlighted text), as has previously been discussed and confirmed.

We are still awaiting the jurisdictional determination from the USACE. To reiterate, within the review area footprint, federal jurisdiction has been indicated by the USACE for E007 and the majority of E014, all of the wetlands with the exception of W006, and the stream features. However, the jurisdictional status of these features, and non-jurisdictional status of the remaining features (E011, E012, and the upper reach of E014), is not official until we receive the USACE approved jurisdictional determination.

Thanks,
Britta

Britta Lees (PWS, TN-QHP)
Specialist, Water Permits, Compliance, & Monitoring
Regulatory Environmental Programs

TENNESSEE VALLEY AUTHORITY

C. 865-771-0051 **E.** bplees@tva.gov
400 West Summit Hill Drive, Knoxville, TN 37902

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From: Brooke Heriges <Brooke.Heriges@tn.gov>
Sent: Friday, August 12, 2022 2:54 PM
To: Lees, Britta Paule <bpdimick@tva.gov>
Cc: NashvilleRegulatory@usace.army.mil
Subject: TVA-Cumberland Fossil Plant HD DWR ID #31299

This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

Please find attached the hydrologic determination letter for the above-referenced site. If you have any questions, do not hesitate to reach out. Thank you for your time and the opportunity to review this submittal.

Sincerely,

TN Department of Environment & Conservation

Brooke Heriges| Environmental Scientist
Division of Water Resources
Nashville Field Office
711 R.S. Gass Blvd, Nashville, TN 37216
p. 615-767-1430
Brooke.Heriges@tn.gov
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We encourage electronic submittals. Please send submittals to dwr.nefo@tn.gov.

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Appendix F – CUF Wetlands Report

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THE TENNESSEE VALLEY AUTHORITY

Cumberland Fossil Plant

Study Area

Technical Report

Wetland Assessment

Britta Lees, Fallon Parker Hutcheon, Kenneth McMahan

September 14, 2021

This study has been prepared as a supporting document for the Cumberland Fossil Plant (CUF) Environmental Impact Statement (EIS) and is being distributed for project use. The study provides a summary of documented wetland habitats present in the CUF study area, Stewart County, TN.

Introduction

Wetlands are those areas inundated or saturated by surface or groundwater such that vegetation adapted to saturated soil conditions are prevalent. Examples include bottomland forests, swamps, wet meadows, isolated depressions, shallow embayments, and shoreline fringe wetland along the edges of watercourses, impoundments, or lake systems. Wetlands provide many societal benefits such as toxin absorption and sediment retention for improved downstream water quality, storm water impediment and attenuation for flood control, shoreline buffering for erosion protection, and provision of fish and wildlife habitat for commercial, recreational, and conservation purposes. Therefore, a wetland assessment was performed to ascertain wetland presence, condition, and extent to which wetland functions are provided within the Cumberland Fossil Plant and associated review area footprint.

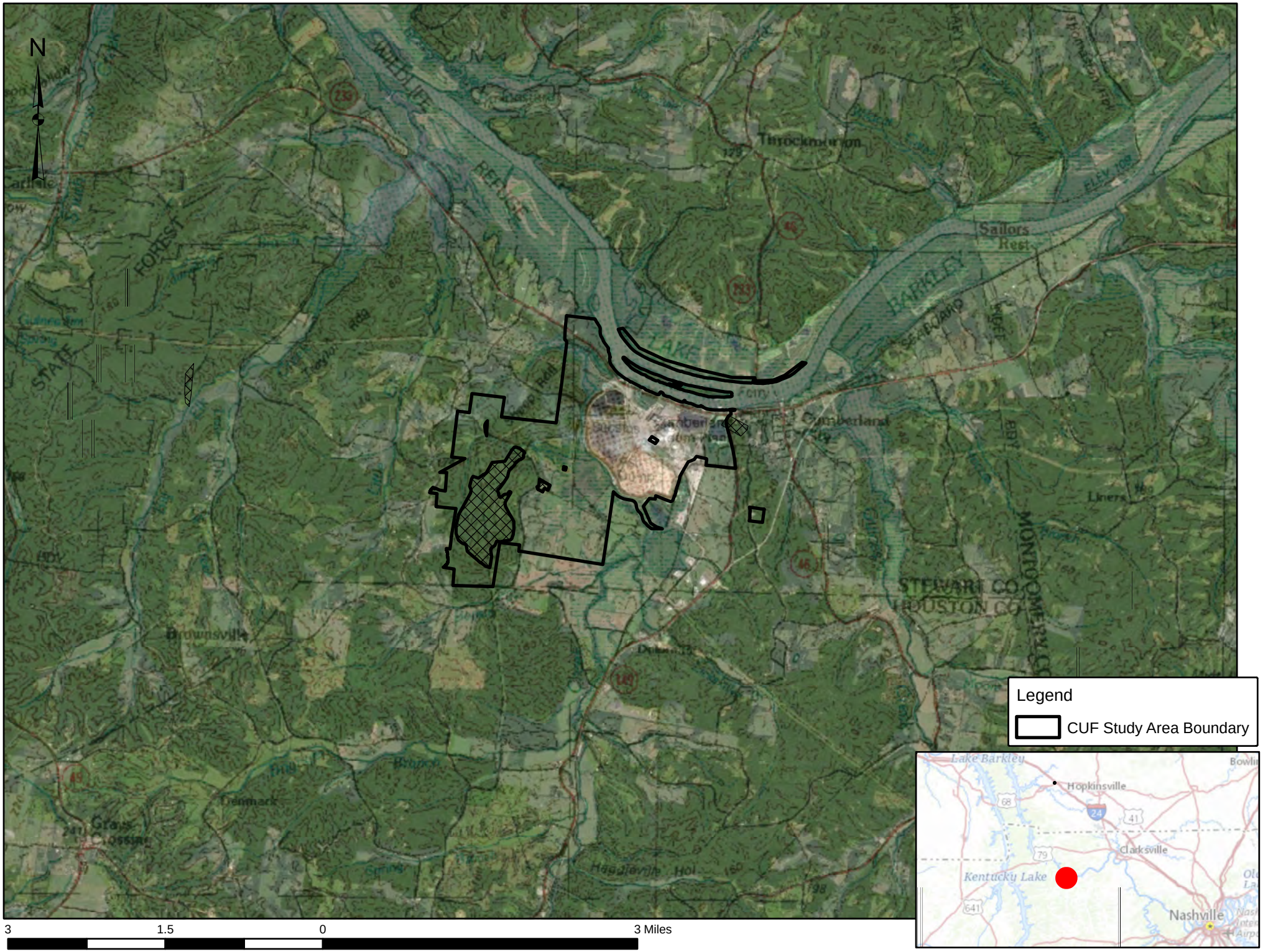
Wetlands are protected under Sections 404 and 401 of the Clean Water Act (CWA) and by Executive Order (EO) 11990 - Protection of Wetlands. In order to conduct specific activities in wetlands, authorization under a Section 404 Permit from the U. S. Army Corps of Engineers (USACE) may be required depending on the wetland's size and hydrologic connectivity to a navigable waterway. Section 401 gives states the authority to certify whether activities permitted under Section 404 are in accordance with state water quality standards. In Tennessee, the Department of Environment and Conservation, Division of Water Pollution Control is responsible for issuing Section 401 water quality certification through the Aquatic Resource Alteration Permit. EO 11990 requires all federal agencies to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities.

Project Location

Cumberland Fossil (CUF) Plant and extended review area ("study area") are located in Stewart County, Tennessee, comprising approximately 2,065 acres adjacent to the south side of the Cumberland River between mile marker 102 and 105 (36.392197, -87.653172) (Figure 1). The CUF plant site covers roughly 630 acres of the total review area footprint, where CUF operations are on going. The extended review area consists of 1,435 acres south, west, and east of the CUF plant and surrounding a new landfill area on site. In addition, the island north of the CUF plant totaling 35 acres in the Cumberland River and the north shoreline of the Cumberland River totaling 60 acres are part of the CUF study area.

The CUF study area is located in the Lower Cumberland River watershed basin (HUC-05130205). The Cumberland River stretch in this vicinity is considered fully supporting and in attainment of state water quality standards. Wells Creek borders the south and west sides of the CUF plant and bisects the study area. This stretch of Wells Creek is included on Tennessee's list of impaired waters, under Section 303(d) of the Clean Water Act, due to high bacterial load (EPA 2020). Wetlands function in water quality improvement; and the majority of wetlands within the CUF study area are tributary to this impaired reach of Wells Creek.

Figure 1. Cumberland Fossil Plant Location Map



Study Area Description

The 630 acres comprising the CUF plant site contain an active coal powered fossil plant and associated infrastructure. The site is developed for industrial power generation, remains under continuous operation and maintenance, where activities currently include ash pond closures. The 1,435 acres of the study area outside the CUF plant site to the south and west is comprised of rolling to steeper grade terrain, dissected by valleys tributary to the floodplain complex associated with the embayment of Wells Creek in this vicinity. Rolling terrain has been converted from cattle pasture to naturalized habitat, where successional communities are evident. Steeper grade slopes were found to be comprised of mature upland forest. This study area surrounds but does not include the new landfill site within the wide valley located central to the study area. Old Scott Road is a gravel road passing east-west through this area, connecting the CUF plant site to the new landfill area and west to Scott Chapel Road. The study area also contains local distributor and TVA electric utility line rights-of-way, where vegetation is maintained at low stature compatible with conductor clearance. Immediately east of the CUF plant site, but within the study area boundary, is an inundated valley flat tributary to the Cumberland River. The study crosses Cumberland City Road to include the southern shoreline of the Cumberland River where barge terminals, mooring cells, and coal unloading infrastructure is present. The island and the northern shoreline of the Cumberland River immediately north of the CUF plant site is part of the review footprint area, as well. The island is dominated by riparian forest habitat and the north shoreline is intermixed with naturalized trees and shrubs adjacent to active farmland.

Preliminary Wetland Review

Initial wetland screening for the CUF site and study area and associated project review area involved an evaluation of mapped resources indicative of wetland presence (Figure 2).

> *National Wetland Inventory* (NWI) (Figure 2) maps a total of 45 acres of forested and 12 acres of scrub-shrub wetland associated with the Scott Creek/Wells Creek floodplain; one <1 acre forested wetland and a 1 acre scrub-shrub wetland along the northern shoreline of the Wells Creek embayment near the Cumberland River; nearly 5 acres of scrub-shrub wetland in association with the 18 acres of mapped ponded wetland immediately east of the CUF plant site; eight freshwater ponds totaling ~8 acres and 24 linear riverine features totaling 22 acres scattered across the CUF study area; roughly 140 acres of open water habitat associated with the Wells Creek embayment and the Cumberland River; and 220 acre of open water excavated features representative of the ash ponds (USFWS 2021).
>
> *U.S. Geological Survey Topography Maps* and *Digital Elevation Models* indicate lower elevation within wide valley flats tributary to Scott Creek and Wells Creek, where geomorphic position would be conducive to wetland development (USGS 1984, 2016).
>
> *Soil Survey Geographic Database* (Figure 2) maps approximately 70 acres of Melvin silt loam, a hydric soil series identified as poorly drained and frequently flooded. Mapped hydric soils can be indicative of wetland presence due the capacity for water retention at extended durations (Soil Survey 2021).
>
> *Aerial Imagery* shows the active CUF plant infrastructure and surrounding study area as field and forest. Inundated and saturated conditions are evident on aerial imagery, and predictive of wetland presence within the CUF study area (Microsoft 2021).

Previous wetland delineations and site assessments conducted and compiled by TVA in 2014

were utilized in this review. Subsequent field surveys aimed to verify or update previously mapped wetlands and address wetland presence or absence within the full review area footprint.

Wetland Determinations

Field reviews were completed in July and August 2021 to determine wetland presence, extent, and condition within the study area. Wetland determinations were performed according to the USACE standards, which require documentation of wetland hydrology, hydric soil, and hydrophytic (wet-site) vegetation (Environmental Laboratory 1987; USACE 2012), as follows:

Hydrology indicators are commonly observed features indicative of groundwater or surface water presence within the evaluated area. This may include obvious indicators such as surface water, saturated soils, a high water table or drift deposits. Less obvious hydrology indicators may suffice if present in combination to meet the hydrology parameter for wetland determination, including crayfish burrows, drainage patterns, soil cracks, or sparsely vegetated concave surface.

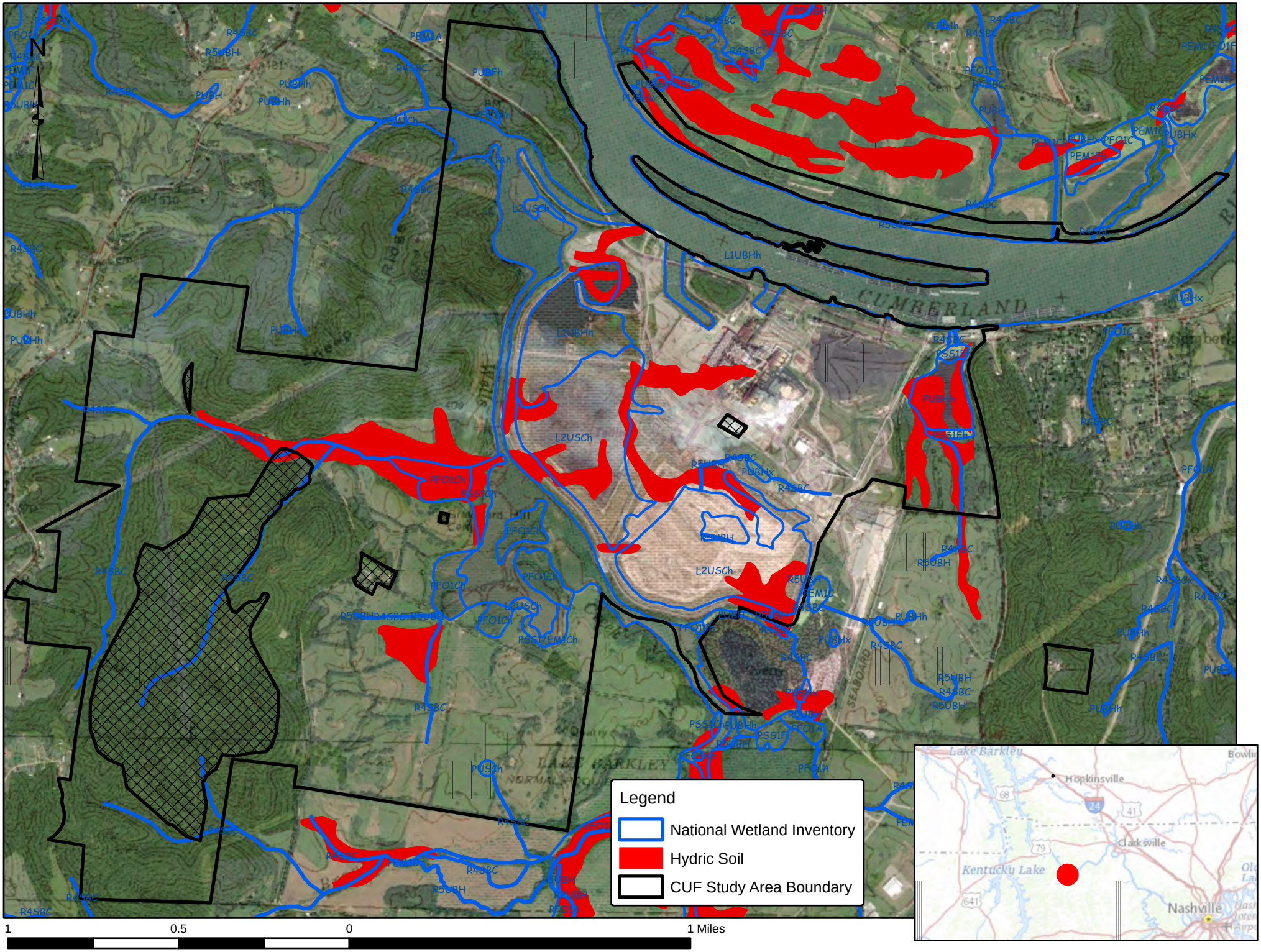
Vegetation is identified within four stratum, to extent all strata were present: woody vines, herbs, shrubs/saplings, and trees. The wetland indicator status has been determined for each identified species on the National Wetland Plant List (USACE 2018), and defined as:

- Obligate Wetland (OBL) >99% occurrence in wetlands
- Facultative Wetland (FACW) 67-99% occurrence in wetlands
- Facultative (FAC) 34-66% occurrence in wetlands
- Facultative Upland (FACU) 1-33% occurrence in wetlands
- Upland (UPL) <1% occurrence in wetlands

Dominant species are defined as those with absolute cover value greater than 20% of total vegetative cover within a strata. Under normal circumstances, if greater than half of the dominant species are FAC, FACW, or OBL, the hydrophytic vegetation parameter is met for wetland determination.

Soils cores were extracted to a depth of 12-to-20 inches to determine the presence of hydric soil indicators near the soil surface. Soil coloration was analyzed using field color chips (Munsell 2010), and documented accordingly. Soils were determined to be hydric wherever soil coloration met the definition of a hydric soil indicator. This is most commonly illustrated in this region by indicators of a depleted matrix.

Figure 2. Cumberland Fossil Plant -- National Wetland Inventory and Soil Survey Geographic Database



Wetland Condition was evaluated using the Tennessee Rapid Assessment Method (TRAM) wetlands, which quantifies wetland function and classifies wetlands into three categories: low, moderate quality, or exceptional resource value (TDEC 2015). Low quality wetlands are degraded aquatic resources which may exhibit low species diversity, minimal hydrologic input and connectivity, recent or on-going disturbance regimes, and/or predominance of non-native species. These wetlands provide low functionality and are considered low value. Moderate quality wetlands provide functions at a greater value due to a lesser degree of degradation and/or due to their habitat, landscape position, or hydrologic input. Moderate quality wetlands are considered healthy water resources of value. Disturbance to hydrology, substrate and/or vegetation may be present to a degree at which valuable functional capacity is sustained. Wetlands with exceptional resource value provide high functions and values within a watershed or are of regional/statewide concern. Those wetlands would exhibit little, if any, recent disturbance, provide essential and/or large scale stormwater storage, sediment retention, and toxin absorption, contain mature vegetation communities, and/or offer habitat to rare species.

Forty-one wetland complexes totaling nearly 210 acres were delineated and assessed during the field reconnaissance (Figure 3, Table 1, Appendix A, Appendix B, Appendix C). Wetland boundaries were mapped with a Trimble R1 receiver equipped with a global navigation satellite system capable of sub-meter accurate measurements. Delineated boundaries were post-processed using ESRI ArcGIS and ArcMap 10.5 software. Potential for wetland presence was assessed using office-level resources for the island and north shoreline. These areas were identified as having potential for wetland presence throughout (Table 2).

Figure 3. Cumberland Fossil Plant Wetland Delineation 2021.

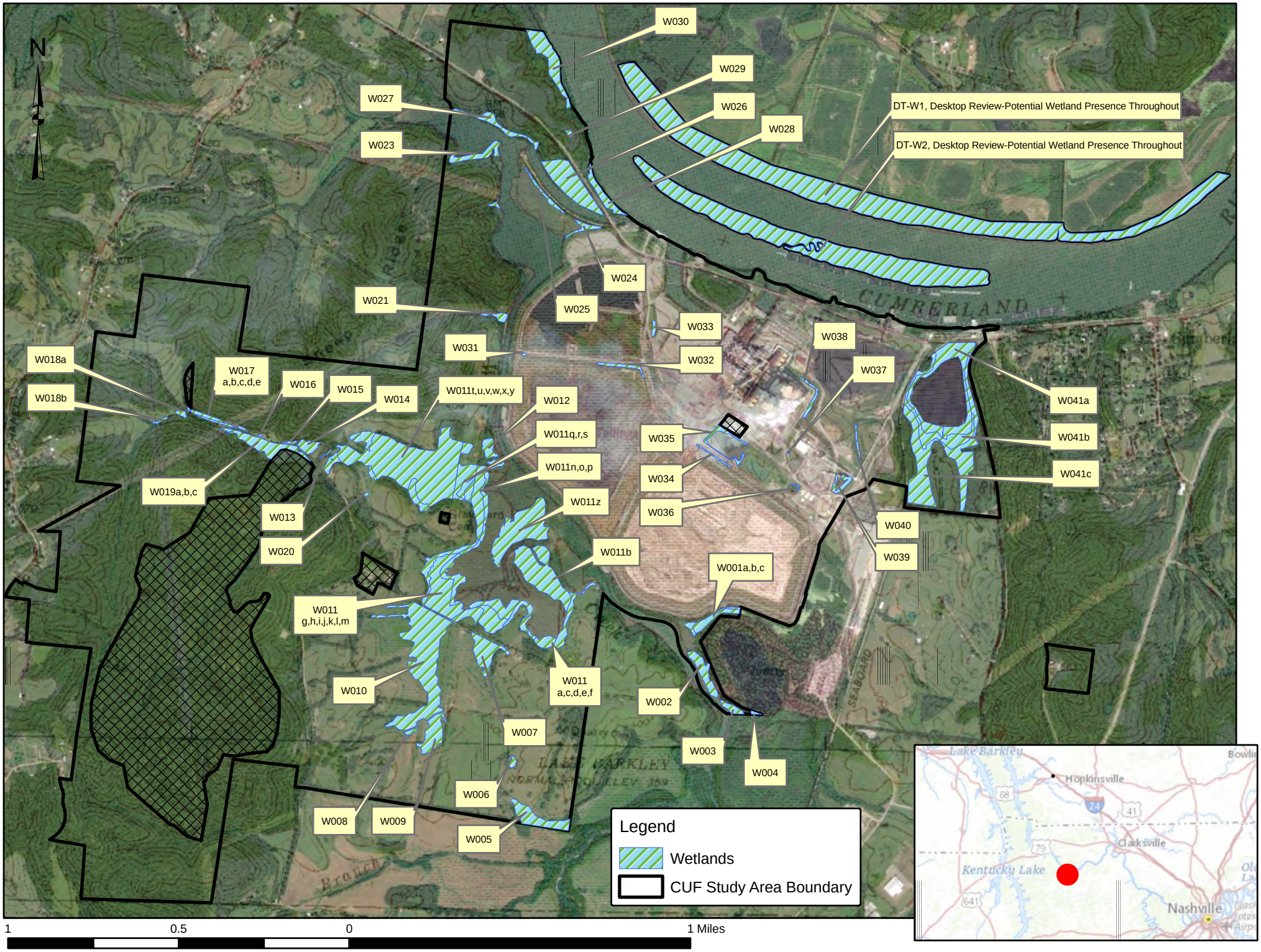


Table 1: Wetland Area Delineated on Cumberland Fossil Plant Property.

Wetland Identifier	Wetland Type[1]	TRAM Category (Score)	Total Wetland Acreage on Site	Location
W001a	PSS1E	Moderate (48)	0.21	Wells Creek Embayment South of Cumberland Fossil Plant
W001b	PAB4/UBHx		1.51	
W001c	PFO1E		0.42	
W002	PEM/FO1E	Moderate (47)	2.32	
W003	PFO1E	Moderate (46)	0.76	
W004	PFO1E	Low (41)	0.11	
W005	PFO1E	Moderate (52)	3.48	Booster Branch Floodplain
W006	PEM/SS/FO1E	Low (38)	0.39	Southeastern Field South of Cumberland Fossil Plant
W007	PSS1E	Moderate (50)	3.55	
W008	PEM1E	Moderate (52)	0.34	Southwestern Field South of Cumberland Fossil Plant
W009	PEM1E		3.25	
W010	PEM/SS/FO1E		18.46	
W011a	PEM1E	Moderate (65)	1.86	Large Floodplain Wetland Complex along South Side of Wells Creek Southwest of Cumberland Fossil Plant Wells Creek Floodplain West of Plant
W011b	PFO1E		9.03	
W011c	PFO1C		1.05	
W011d	PEM1E		0.17	
W011e	PFO1C		0.51	
W011f	PEM1E		0.99	
W011g	PFO1E		2.66	
W011h	PSS1C		2.39	
W011i	PEM1E		1.40	
W011j	PFO1C		6.87	
W011k	PEM1E		2.12	
W011l	PSS1C		2.15	
W011m	PSS1C		0.35	
W011n	PSS1C		1.36	
W011o	PFO1E		4.03	
W011p	PEM1C		0.67	
W011q	PSS1C		0.70	
W011r	PEM1E		2.33	
W011s	PEM1E		0.57	
W011t	PFO1E		25.91	
W011u	PEM1E		1.33	
W011v	PEM1E		0.32	
W011w	PEM1E		0.79	
W011x	PSS1E		1.09	
W011y	PEM1E		0.24	
W011z	PFO1E		9.30	
W012	PFO1C	Moderate (51)	1.11	

Table 1 (continued): Wetland Area Delineated on Cumberland Fossil Plant Property.

Wetland Identifier	Wetland Type[1]	TRAM Category (Score)	Total Wetland Acreage on Site	Location
W013a	PFO1E	Low (27)	0.07	Roadside Drains South of Landfill Access Road
W013b	PEM1E		0.04	
W014	PSS1E	Low (39)	1.11	Bottomland Areas Adjacent and North of Old Scott Road
W015	PFO1E	Low (41)	0.14	
W016	PEM1E	Low (30)	0.03	
W017a	PEM1E	Low (36)	0.12	
W017b	PEM1E		0.01	
W017c	PEM1E		0.11	
W017d	PEM1E		0.27	
W017e	PFO1E		0.59	
W018a	PFO1E	Low (41)	0.27	Bottomland Areas Adjacent and South of Old Scott Road
W018b	PEM1E		0.20	
W019a	PEM1E	Moderate (46)	0.15	
W019b	PFO1E		3.55	
W019c	PEM1E		0.00	
W020	PEM1E	Low (26)	0.11	Field West of Cumberland Fossil Plant
W021	PEM/FO1E	Moderate (48)	0.68	Wells Creek Embayment West of Cumberland Fossil Plant
W022	PFO1E	Low (44)	0.19	
W023	PFO1E	Moderate (53)	1.84	
W024	PSS/FO1E	Moderate (53)	0.79	
W025	PSS/FO1E	Moderate (53)	0.73	
W026	PFO1E	Moderate (54)	6.86	
W027	PFO1E	Moderate (53)	1.93	
W028	PFO1E	Moderate (53)	1.84	Northwest of Plant Cumberland River South Shoreline
W029	PFO1E	Low (26)	0.17	
W030	PFO1E	Moderate (54)	4.43	
W031	PEM1Ex	Low (15)	0.06	Cumberland Fossil Plant Site
W032	PEM1Ex		0.75	
W033	PEM1Ex		0.27	
W034	PEM1Ex		0.31	
W035	PEM1/UBHx		0.94	
W036	PEM1/UBHx		0.08	
W037	PEM/SS1Ex		0.03	
W038	PEM/SS1Ex		0.68	
W039	PEM1Ex		0.84	
W040	PEM1Ex		0.38	
W041a	PEM1E	Moderate (52)	8.10	East/Adjacent to Cumberland Fossil Plant
W041b	PSS1E		4.60	
W041c	PFO1E		13.78	
		TOTAL	**209.26**	

[1]Classification codes as defined in Cowardin et al. 1979: AB4 = Aquatic Bed, floating; E = seasonally flooded/saturated; C = seasonally flooded; P = Palustrine; EM1 = emergent, persistent vegetation; FO1= forested, broad-leaved deciduous vegetation,seasonally flooded/saturated; SS1= scrub-shrub, broad-leaved deciduous vegetation; UB = unconsolidated bottom; x = excavated.

Table 2: Wetlands Identified by Office Level Review on Cumberland Fossil Plant Property.

Wetland Identifier	Wetland Type[1]	Mapped Potential Wetland Acreage	Location
DT-W1	PFO1E	59.15	North Cumberland River Shoreline
DT-W2	PEM/SS/FO1E	36.15	Cumberland River Island
	TOTAL	**95.30**	

[1]Classification codes as defined in Cowardin et al. 1979: E = seasonally flooded/saturated; P = Palustrine; EM1 = emergent, persistent vegetation; FO1= forested, broad-leaved deciduous vegetation,seasonally flooded/saturated; SS1= scrub-shrub, broad-leaved deciduous vegetation.

Wetland Descriptions

W001a,b,c comprise an impounded channel and associated wetland habitat adjacent to the south side of the CUF plant site. W001a represents scrub-shrub habitat along the shoreline fringe, dominated by buttonbush (*Cephalanthus occidentalis*). W001a is adjacent to W001b, which is comprised of open water and floating duckweed (*Lemna minor*). W001b forms a forested wetland area that functions as the dam for this impoundment, where beaver activity is evident. Dominant forest cover in W001c is comprised of sugarberry (*Celtis laevigata*) and American elm (*Ulmus americana*). W001 covers 2.41 acres total, and exhibit inundation and saturated soil, resulting in a grey and mottled soil coloration indicative of hydric conditions. W001 scored as moderate quality due to size, habitat interspersion, and hydrologic influence on downstream waters, coupled with indication of past disturbance.

W002 is wetland flat within the Wells Creek floodplain comprised of forested habitat except where it crosses under a TVA utility line right-of-way where vegetation is maintained as emergent. This wetland area totals 2.32 acre within the study area. Due to its floodplain setting, presence of drainage patterns and drift deposits, sufficient hydrology has resulted in hydric soil coloration. W002 was dominated by knotweed (*Persicaria hydropoiperoides*) in the emergent portion and sycamore (*Platanus occidentalis*) and American elm in the forested portion, all of which are wetland species. W002 scored as moderate quality, offering healthy wetland functions and values within this landscape.

W003 is a 0.76 acre forested wetland flat within the Wells Creek floodplain. Saturated soils have resulted in grey and mottled soil coloration, indicative of hydric conditions. W003 is dominated by sycamore and American elm in the over story, both of which are wetland species. W003 scored as moderate quality, offering healthy wetland functions and values within this landscape.

W004 is a 0.11 acre forested wetland flat along a ponded area that extends outside the CUF study area. Saturated soils have resulted in grey and mottled soil coloration, indicative of hydric conditions. W004 is dominated by sycamore and American elm in the over story, both of which are wetland species. W004 scored as low quality, offering less than desirable wetland functions and values due to the isolated nature of the excavated pond with which it is associated.

W005 is a forested wetland bottom associated with the floodplain of Booster Creek with 3.48 acres located at the southeastern corner of the study area, but extending off site. Drift deposits, drainage patterns, and geomorphic position provide adequate indications of wetland hydrology. Soils are grey and mottled near the surface, indicative of hydric conditions. W005 is dominated by sycamore and American elm in the over story, both of which are wetland species. W005 scored as moderate quality, offering healthy wetland functions and values within this landscape.

W006 is a 0.39 acre depression, previously excavated for a cattle pond. This depression has filled in with wetland vegetation, resulting emergent, scrub-shrub, and forest habitat intermixed throughout. Soils in W006 were saturated, resulting in grey and mottled coloration, indicative of hydric conditions. Black willow (*Salix nigra*) trees, box elder (*Acer negundo*) and green ash (*Fraxinus pennsylvanica*) saplings with a ground layer of wetland grasses (*Cinna arundinacea*, *Glyceria striata*, *Panicum dichotomilforum*, *Coleataenia rigidula*) dominated W006. This wetland scored as low quality, offering less than desirable wetland functions and values to the surrounding due to its isolated nature.

W007 is an extension of the larger Wells Creek embayment and floodplain, separated by a gravel road and located within the southeastern field in the CUF study area. This wetland area totals 3.55 acres, and represents successional habitat dominated by black willow, green ash, and honey locust (*Gleditsia tricanthos*) saplings. Soils were inundated and saturated, resulting in a depleted matrix near the surface, indicative of hydric conditions. This wetland scored as moderate quality, offering healthy functions and values to the surrounding landscape.

W008 and W009 comprise the southern reaches of the Wells Creek floodplain, separated from W010 immediately to the north by an upland field road. These wetland areas were dominated by emergent, fallow field vegetation, comprising 0.34 acre in W008 and 3.25 acres in W009. W008 and W009 receive hydrology from surrounding runoff and would experience groundwater influence with rise in the floodplain water table. W008 and W009 exhibited drainage patterns, with saturation visible on aerial imagery. Soils were inundated and saturated, resulting in a depleted matrix near the surface, indicative of hydric conditions. These wetlands features were dominated by giant goldenrod (*Solidago gigantea*), sedges (*Carex lurida, C. festucaea*), and Nepalese browntop (*Microstegium vimineum*). These wetlands scored as moderate quality, offering healthy functions and values to the surrounding landscape.

W010 is an extension of the larger Wells Creek embayment and floodplain, separated by a gravel road and located within the southwestern field in the CUF study area. This wetland area totals 18.46 acres, and contains emergent, scrub-shrub successional habitat, and linear forested features within the complex. Soils were inundated or saturated, resulting in a depleted matrix near the surface, indicative of hydric conditions throughout. Emergent wetland habitat sampled in W010 was dominated by sedges (*Carex tribuloides*, *C. festuca, C. lurida, C. frankii*). Scrub-shrub wetland habitat was comprised of black willow, green ash, and honey locust saplings. Forested wetland features were found to be dominated by sugarberry. This wetland complex scored as moderate quality, offering healthy functions and values to the surrounding landscape.

W011a-z consists of large extended wetland area forming the floodplain riparian complex at the confluence of Scott Creek with Wells Creek, totaling 80 acres. This wetland complex contains an intermixture of habitat types including mud flats (<1 acre), emergent wet meadows (12 acres), scrub-shrub (7 acres), successional and sapling dominated young forest and mature forest (60 acres). Hydrology throughout this complex consists of receiving and storing runoff from the adjacent landscape and flood water influence as both the Scott and Wells Creek systems respond to precipitation and increased runoff from the surrounding watershed. Soils exhibited grey and mottled coloration, indicative of hydric conditions. Dominant emergent vegetation in sampled areas consisted of wetland sedges (*Carex* spp.), grasses (*Panicum* spp., *Coleataenia* sp.). and rushes (*Scirpus* spp., *Juncus* spp., *Cyperus* spp.), and a diversity of forbs. Scrub-shrub habitat was found to be dominated by buttonbush, an obligate wetland species. Forested wetland sampled within this complex were dominated by sycamore, sweetgum (*Liquidambar styraciflua*), water oak (*Quercus nigra*), and bald cypress (*Taxodium distichum*). This wetland complex scored

in the upper range of moderate quality due to its large size, interspersed communities, influence on downstream waters, coupled against disturbance regime and intensity of surrounding land use.

W012 is a 1.11 acre forested wetland adjacent to open water to the east. This feature exhibits saturated soils, a high water table, water marks on trees, grey and mottled soil coloration, indicative of hydric conditions. Dominant wetland vegetation includes bald cypress (*Taxodium distichum*), black willow (*Salix nigra*), sugarberry (*Celtis laevigata*), and buttonbush (*Cephalanthus occidentalis*). W012 offers moderate TRAM values due to size and hydrologic influence.

W013a and W013b comprise a linear wetland drainage feature containing 0.07acre of forested wetland in W013a and 0.04 acre of emergent wetland tributary to W011. These features are regularly inundated, and exhibited grey and mottled hydric soil. W013 scored as low value due to small size, disturbance history, and lack of hydrologic influence.

W014 is a scrub-shrub wetland complex totaling 1.11 acre within the Scott Creek floodplain. W014 has been impacted by the new road installed to accommodate access between the CUF plant and landfill disposal area. Currently, W014 was dominated by buttonbush and greenash saplings. The floodplain landscape position provides adequate wetland hydrology, evident by the grey and mottled soil coloration, indicative of hydric conditions. W014 offers low wetland value and less than desirable wetland function due to is small size, disturbance history, and lack of hydrologic influence.

W015 totals 0.14 acre of forested wetland on the north side of the gravel Old Scott Road within the floodplain of Scott Creek. This feature also exhibits seepage hydrology and a local landowner in 2014 indicated the area was spring fed and adjacent to an old homestead, of which a small barn still remains. Inundated and saturated soils have resulted in grey and mottled soil coloration, indicative of hydric conditions. Dominant wetland vegetation consists of black willow and American elm in the overstory, with red maple (*Acer rubrum*) and grey dogwood (*Cornus racemosa*) in the understory, and jewelweed (*Impatiens capensis*), giant goldenrod, and cattails (*Typha latifolia*) in the ground layer. This wetland offers low value due to its small size and disturbance history.

W016 is roadside depression totaling 0.03 acre. Vegetation is maintained as emergent due to mowing within a local distributor's overhead utility line right-of-way. Indicators of wetland hydrology have resulted in hydric soil coloration. Dominant vegetation consisted of annual ivy (*Iva annua*) and green bulrush (*Scirpus atrovirens*), both of which are wetland species.

W017a,b,c,d,e is wide linear wetland feature within a valley flat containing Scott Creek and adjacent to Old Scott Road. W017a consists of emergent wetland habitat within the right-of-way regularly mowed for vegetation management under an overhead electric utility line. W017b is a narrow linear feature connecting W017a to W017c. W017c comprises disturbed wetland habitat where earth moving and vehicle use is apparent, within a larger overhead utility line right-of-way. W017d is reflective of W017a, containing similar emergent habitat maintained within the right-of-way of the electric lines for a local distributor. W017e is the intact forested portion of this wetland complex located outside the maintained emergent wetland habitat. W017 totals 1.1 acre, contained inundated or saturated soils, drainage patterns, and hydric soil coloration. Emergent wetland habitat was dominated by sedges (*Carex lurida*) in the sampled area; forested wetland habitat was dominated by sycamore, box elder, and sweetgum, all of which are wetland species. This complex scored as low quality due to size and disturbance regime.

floodplain, but south of Old Scott Road. W018a comprises an forested wetland area totaling 0.27

W021 totals 0.68 acre of forested and emergent wetland adjacent and tributary to Wells Creek. This wetland is predominantly forested, although a portion of emergent wetland habitat is located within the right-of-way of an overhead electric utility line. This wetland flat is seasonally saturated and has developed hydric soil coloration. Emergent wetland area was dominated by sedges (*C. lurida, C. tribuloides*). Forested wetland area was dominated by sycamore and silver maple (*Acer saccharinum*). W021 provides low wetland value due to the predominance of invasive species, and lack of hydrologic influence on downstream waters.

W022 comprises 0.44 acre of forested wetland in a wide valley flat at the confluence with Wells Creek. This wetland exhibited drift deposits and drainage patterns over soils with a grey and mottled coloration near the surface, indicative of hydric conditions. W022 was dominated by green ash and sugarberry, both wetland trees. The small size of W022 and lack of hydrologic influence results in low functional capacity.

W023 comprises 1.83 acre of forested wetland flat along the Wells Creek embayment near the confluence with the Cumberland River. This wetland exhibited drift deposits and drainage patterns over soils with a grey and mottled coloration near the surface, indicative of hydric conditions. W023 was dominated by red maple and sugar maple, both wetland trees. The size and landscape position of W023 coupled with hydrologic influence results in moderate functional capacity for this wetland feature.

W024 comprises 0.79 acre of forested and scrub-shrub intermixed wetland flat along the Wells Creek embayment near the confluence with the Cumberland River. This wetland feature is located between an old roadbed to the north, the CUF plant site to the east, and the embayment to the southwest. W024 is inundated regularly, and exhibits hydric soil coloration. Dominant trees consisted of red maple and sugar maple, interspersed with grey dogwood and buttonbush shrubs,

all of which are wetland species. The size and landscape position of W024 coupled with hydrologic influence results in moderate functional capacity for this wetland feature.

W025 comprises 0.73 acre of forested and scrub-shrub intermixed wetland fringe along the Wells Creek embayment near the confluence with the Cumberland River. This wetland feature is located along an old roadbed extending into the Wells Creek embayment. W025 is inundated regularly, and exhibits hydric soil coloration. Dominant trees consisted of red maple and sugar maple, interspersed with grey dogwood and buttonbush shrubs, all of which are wetland species. . The size and landscape position of W025 coupled with hydrologic influence results in moderate functional capacity for this wetland feature.

W026 comprises 6.86 acres of forested wetland flat along the Wells Creek embayment near the confluence with the Cumberland River. This wetland exhibited drift deposits and drainage patterns over soils with a grey and mottled coloration near the surface, indicative of hydric conditions. W026 was dominated by sugarberry, sycamore, red maple, and sugar maple, all of which constitute wetland trees. The size and landscape position of W026 coupled with hydrologic influence results in moderate functional capacity for this wetland feature within the landscape.

W027 comprises 1.93 acre of forested wetland flat along the north side of the Wells Creek embayment near the confluence with the Cumberland River. This wetland exhibited drift deposits and drainage patterns over soils with a grey and mottled coloration near the surface, indicative of hydric conditions. W027 was dominated by sugarberry, sycamore, red maple, and sugar maple, all of which comprise wetland tree species. The size and landscape position of W027 coupled with hydrologic influence results in moderate functional capacity, providing heathy wetland benefits to the surrounding watershed.

W028 comprises 1.84 acre of forested wetland flat within the floodplain of the Cumberland River. This wetland exhibited drift deposits and drainage patterns over soils with a grey and mottled coloration near the surface, indicative of hydric conditions. W028 was dominated by American elm, sycamore, box elder, and sugar maple, all of which comprise wetland species. The size and landscape position of W028 coupled with hydrologic influence results in moderate functional capacity, providing heathy wetland benefits to the surrounding watershed.

W029 is a 0.17 acre old excavated depression containing young sugarberry trees. This depression contained surface water and soils were grey and mottled near the surface, indicative of hydric conditions. This wetland scored as low quality, offering less than desirable wetland functions and values to the surrounding due to its isolated nature.

W030 comprises 4.43 acre of forested wetland flat within the floodplain of the Cumberland River. This wetland exhibits drift deposits and drainage patterns over soils with a grey and mottled coloration near the surface, indicative of hydric conditions. W030 was dominated by American elm, sycamore, box elder, and sugar maple, all of which are wetland species. The size and landscape position of W028 coupled with hydrologic influence results in moderate functional capacity, providing heathy wetland benefits to the surrounding watershed.

W031, W032, W033, W034, W38, W039 and W040 are located in wide swales on the active CUF plant site where excavation for drainage purposes has allowed for wetland parameters to develop. These areas were nearly entirely dominated by giant reed (*Phragmites australis*) and contained inundated or saturated soils with grey coloration indicative of hydric conditions. Similarly, W036 and W037 constitute constructed depressions on the CUF plant site exhibiting wetland parameters. Due to the manmade nature of all these wetland features within an active industrial

site, jurisdictional status is to be determined. Although these wetlands provide wetland functions and values, the extents is low due to their relatively recent development, nature of use, and lack of natural buffers.

W035 comprises a shoreline fringe around a sediment basin. This feature is dominated by giant reed, and inundated with retained water. Although W035 provides wetland function within the basin, this feature would be exempt from wetland regulatory oversight due the jurisdictional status of retention ponds.

W041a,b,c totals 8.10 acres of an emergent, scrub-shrub, and forested wetland complex, respectively, in rough concentric rings around an open water basin immediately east of the CUF plant site and directly tributary to the Cumberland River. Emergent wetland area was dominated by green bulrush, woolgrass (*Scirpus cyperinus*), soft pathrsuh (*Juncus effusus*), and cattails. Scrub-shrub habitat was dominated by buttonbush. Forested wetland area was dominated by green ash, silver maple, American elm, sugarberry, sycamore, and sweetgum. This wetland complex exhibited inundated or saturated soils with grey and mottled coloration, indicative of hydric conditions. W041 scored as moderate quality, indicating a healthy provision of wetland functions and values for the surrounding landscape.

Regulatory

The CUF study area falls within the Nashville USACE regulatory district and the State of Tennessee's regulatory oversight wherever regulated activities may intersect with jurisdictional features. Wetland features may or may not be considered jurisdictional at the federal level based on the current definition of "waters of the U.S.", including wetlands, which commonly requires indications of adjacency or other indicators of hydrologic connectivity to a navigable surface water. A jurisdictional determination may be necessary to ascertain the jurisdictional status of wetland features on site. Certain wetlands within the CUF plant site are likely exempt from jurisdiction due to their constructed nature and/or association with retention or sediment ponds. In accordance with Tennessee's definition of "waters of the State", including wetlands, any wetland feature with a surface or ground water connection fall within the State's regulatory purview. Impacts would be subject to review pursuant to Tennessee's Water Quality Control Act (§69-3-108, 0400-40-07) and anti-degradation policy (§69-3-108, 0400-40-04). To ensure compliance with wetland mandates, project planning would take into account site constraints, including wetland locations, during development design. Wetlands should be avoided to the extent practicable, wetland disturbance minimized, and where avoidance and minimization is not feasible, compensatory mitigation would be required to offset loss of wetland function within the watershed. Mitigation for wetland impacts would align with the USACE guidelines to ensure no net loss of wetland functions and values (73 FR 19594 2008) (EPA 1990). First preference is mitigation via purchase of credits in an approved mitigation bank. If no mitigation banks are available mitigation may be accomplished via payment into an approved in-lieu fee program. Additional options for mitigation include on-site or off-site wetland restoration, wetland creation, or enhancement/preservation.

Conclusion

The CUF study area contains an array of wetland features offering minimal to moderate wetland functions and values within the surrounding watershed. Wetland acreage covers nearly 10% of the study area, and is primarily located within the confluence of the Scott Creek and Wells Creek floodplains. All wetland features on site continue to function in flood storage, stormwater impediment,

toxin absorption, and sediment retention. The jurisdictional status of features within the CUF plant site that meet the wetland definition would need to be ascertained. The majority of the identified wetland area outside the CUF plant site but within the extended study area is tributary to Wells Creek. Because the associated reach of Wells Creek has been identified as impaired, the importance of wetland functions and values tributary to Wells Creek is amplified. Similarly, these wetlands contain successional to intact plant communities, exhibiting a diversity in species composition that supports wildlife forage and habitat. Consideration of these wetland resources will be an important factor in site development.

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Appendix A

USACE Routine Wetland Determination Forms

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W001a**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.380963 **Long.:** -87.655246 **Datum:** NAD83

Soil Map Unit Name: Water **NWI classification:** PSS1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Inundated scrub-shrub shoreline of channel along southern boundary of CUF operating plant site; 0.21 acre; beaver impacted; associated with W001b(ponded) and W001c(forested). TRAM Moderate (48). Photos FPH_5486-90.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches): 2
Water Table Present?	Yes ○	No ◉	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W001a

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0		= Total Cover	

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0		= Total Cover	

Shrub Stratum (Plot size: 5X10')				
1. Cephalanthus occidentalis	70	☑	77.8%	OBL
2. Hibiscus laevis	20	☑	22.2%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	90		= Total Cover	

Herb Stratum (Plot size: 5X10')				
1. Lysimachia nummularia	15	☑	50.0%	FACW
2. Lemna minor	15	☑	50.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30		= Total Cover	

Woody Vine Stratum (Plot size: _____)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	105	x 1 =	105	
FACW species	15	x 2 =	30	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	120	(A)	135	(B)

Prevalence Index = B/A = 1.125

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W001a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W001b**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.380501 **Long.:** -87.655121 **Datum:** NAD83

Soil Map Unit Name: Water **NWI classification:** PUBHx

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Inundated channel covered by duckweed along southern boundary of CUF operating plant site; 1.51 acre; beaver impacted; associated with W001a(scurb shrub fringe) and W001c(forested). TRAM Moderate (48). Photos FPH_5491-2.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches): 24
Water Table Present?	Yes ○	No ◉	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W001b

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5X10')				
1. Lemna minor	80	☑	100.0%	OBL
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	80	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	80	x 1 =	80	
FACW species	0	x 2 =	0	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	80	(A)	80	(B)

Prevalence Index = B/A = 1.000

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W001b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W001c**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.380164 **Long.:** -87.657239 **Datum:** NAD83

Soil Map Unit Name: Water **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Forested wetland functioning as a dam on channel along southern boundary of CUF operating plant site; 0.42 acre; beaver impacted; associated with W001a(scurb shrub fringe) and W001b(duckweed dominated water). TRAM Moderate (48). Photos FPH_5490-5500.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	2
Water Table Present?	Yes ◉ No ○	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W001c

Tree Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis laevigata	40	☑	44.4%	FACW
2. Ulmus americana	30	☑	33.3%	FACW
3. Gleditsia triacanthos	10	☐	11.1%	FAC
4. Acer negundo	10	☐	11.1%	FAC
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	90	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10X25')				
1. Acer negundo	15	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	15	= Total Cover		

Shrub Stratum (Plot size: 10X25')				
1. Cephalanthus occidentalis	10	☑	66.7%	OBL
2. Hibiscus laevis	5	☑	33.3%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	15	= Total Cover		

Herb Stratum (Plot size: 10X25')				
1. Lemna minor	10	☑	16.4%	OBL
2. Murdannia keisak	15	☑	24.6%	OBL
3. Symphyotrichum lateriflorum var. lateriflorum	10	☑	16.4%	FACW
4. Lobelia cardinalis	1	☐	1.6%	FACW
5. Tradescantia virginiana	10	☑	16.4%	FACU
6. Lysimachia nummularia	15	☑	24.6%	FACW
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	61	= Total Cover		

Woody Vine Stratum (Plot size: 10X25')				
1. Campsis radicans	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	10	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 10 (A)

Total Number of Dominant Species Across All Strata: 11 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 90.9% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40
FACW species	96	x 2 =	192
FAC species	45	x 3 =	135
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	191 (A)		407 (B)

Prevalence Index = B/A = 2.131

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W001c

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W002-EM**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.377720 **Long.:** -87.65699 **Datum:** NAD83

Soil Map Unit Name: Water/Linside Silt Loam -- not hydric -- occasionally flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W002-EM; maintained where overhead utility line ROW crosses; associated with W002-FO forested wetland flat on Wells Creek floodplain. 2.32 acres total, of which approximately 1/3red acre is emergent. TRAM Moderate (47). Photos FPH_5501-21.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 2	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W002-EM

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10X25')				
1. Persicaria hydropiperoides	50	☑	58.8%	OBL
2. Eupatorium serotinum	15	☐	17.6%	FAC
3. Tradescantia virginiana	10	☐	11.8%	FACU
4. Boehmeria cylindrica	10	☐	11.8%	FACW
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	85	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	50	x 1 =	50	
FACW species	10	x 2 =	20	
FAC species	15	x 3 =	45	
FACU species	10	x 4 =	40	
UPL species	0	x 5 =	0	
Column Totals:	85	(A)	155	(B)

Prevalence Index = B/A = 1.824

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W002-EM

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W002-FO**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.378460 **Long.:** -87.656687 **Datum:** NAD83

Soil Map Unit Name: Water/Linside Silt Loam -- not hydric -- occasionally flooded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Forested wetland flat on Wells Creek floodplain, associated with portion of emergent wetland habitat (W002-EM; maintained where overhead utility line ROW crosses). 2.32 acres total, of which approximately 2 acres is forested. TRAM Moderate (47). Photos FPH_5501-21.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 2	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W002-FO

Tree Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	30	☑	27.3%	FACW
2. Ulmus americana	30	☑	27.3%	FACW
3. Acer rubrum	10	☐	9.1%	FAC
4. Acer saccharinum	20	☐	18.2%	FACW
5. Fraxinus pennsylvanica	10	☐	9.1%	FACW
6. Juglans nigra	10	☐	9.1%	FACU
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	110	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10X25')				
1. Acer negundo	15	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	15	= Total Cover		

Shrub Stratum (Plot size: 10X25')				
1. Hibiscus laevis	10	☑	100.0%	OBL
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	10	= Total Cover		

Herb Stratum (Plot size: 10X25')				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	10	x 1 =	10
FACW species	90	x 2 =	180
FAC species	25	x 3 =	75
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	135	(A)	305 (B)

Prevalence Index = B/A = 2.259

Hydrophytic Vegetation Indicators:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☑ Dominance Test is > 50%
- ☑ Prevalence Index is ≤3.0 [1]
- ☐ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

buttressed trees

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W002-FO

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W003**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.376729 **Long.:** -87.655013 **Datum:** NAD83

Soil Map Unit Name: Water/Melvin siilt Loam -- hydric -- frequently flooded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Forested wetland flat on Wells Creek Floodplain along southern peninsula south of site study area. 0.76 acres. TRAM Moderate (46). Photos FPH_5522-29.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 2

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W003

Tree Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	30	☑	27.3%	FACW
2. Ulmus americana	30	☑	27.3%	FACW
3. Acer rubrum	10	☐	9.1%	FAC
4. Acer saccharinum	20	☐	18.2%	FACW
5. Fraxinus pennsylvanica	10	☐	9.1%	FACW
6. Juglans nigra	10	☐	9.1%	FACU
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	110	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10X25')				
1. Acer negundo	15	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	15	= Total Cover		

Shrub Stratum (Plot size: 10X25')				
1. Hibiscus laevis	10	☑	100.0%	OBL
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	10	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	90	x 2 =	180
FAC species	25	x 3 =	75
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	135 (A)		305 (B)

Prevalence Index = B/A = 2.259

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W003

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W004**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.376546 **Long.:** -87.653800 **Datum:** NAD83

Soil Map Unit Name: Water/Melvin siilt Loam -- hydric -- frequently flooded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Forested wetland flat along ponded area at furthest extent of southeast peninsula of site study area. 0.11 acre. TRAM Low (41). No photos.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 2

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W004

Tree Stratum (Plot size: 10X10')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	30	☑	42.9%	FACW
2. Ulmus americana	30	☑	42.9%	FACW
3. Acer rubrum	10	☐	14.3%	FAC
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	70	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10X10')				
1. Acer negundo	15	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	15	= Total Cover		

Shrub Stratum (Plot size: 10X10')				
1. Hibiscus laevis	10	☑	100.0%	OBL
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	10	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	10	x 1 =	10	
FACW species	60	x 2 =	120	
FAC species	25	x 3 =	75	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	95	(A)	205	(B)

Prevalence Index = B/A = 2.158

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W004

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W005**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.371912 **Long.:** -87.665131 **Datum:** NAD83

Soil Map Unit Name: Linside Silt Loam -- not hydric -- occasionally flooded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Foreseted wetland bottom in Booster Creek Floodplain at southeast corner of site; TRAM Moderate (52). Photos BPL_4013-16.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W005

Tree Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	30	☑	37.5%	FACW
2. Ulmus americana	15	☑	18.8%	FACW
3. Quercus michauxii	15	☑	18.8%	FACW
4. Quercus palustris	10	☐	12.5%	FACW
5. Fraxinus pennsylvanica	10	☐	12.5%	FACW
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	80	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10X25')				
1. Acer negundo	15	☑	60.0%	FAC
2. Asimina triloba	10	☑	40.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	25	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10X25')				
1. Persicaria hydropiperoides	15	☑	100.0%	OBL
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	15	= Total Cover		

Woody Vine Stratum (Plot size: 10X25')				
1. Smilax rotundifolia	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	15	x 1 =	15	
FACW species	80	x 2 =	160	
FAC species	30	x 3 =	90	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	125	(A)	265	(B)

Prevalence Index = B/A = 2.120

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W005

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/2	80	10YR 4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W006**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Depression **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.374288 **Long.:** -87.666496 **Datum:** NAD83

Soil Map Unit Name: Maury Silt Loam -- not hydric -- well drained **NWI classification:** PEM/SS/FO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Old pond converted to wetland in southeast field south of CUF; intermixed trees with growing saplings and emergent ground layer; 0.39 acre; TRAM Low (38). Photos BPL_4010-12.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 2

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W006

Tree Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Salix nigra	30	☑	100.0%	OBL
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	30	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10X25')				
1. Acer negundo	10	☑	50.0%	FAC
2. Fraxinus pennsylvanica	10	☑	50.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10X25')				
1. Cinna arundinacea	10	☑	20.0%	FACW
2. Glyceria striata	10	☑	20.0%	OBL
3. Panicum dichotomiflorum	10	☑	20.0%	FACW
4. Coleataenia rigidula	10	☑	20.0%	FACW
5. Bidens aristosa	10	☑	20.0%	FACW
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	50	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	8	(A)
Total Number of Dominant Species Across All Strata:	8	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40	
FACW species	50	x 2 =	100	
FAC species	10	x 3 =	30	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	100	(A)	170	(B)

Prevalence Index = B/A = 1.700

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W006

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-4	10YR	4/2	100						Silt Loam	
4-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W007**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.379226 **Long.:** -87.667498 **Datum:** NAD83

Soil Map Unit Name: Linside Silt Loam -- moderately well drained -- occasionaly flooded **NWI classification:** PSS1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Floodplain of Wells Creek, south of old field road in southeast field south of CUF;successional scrub-shrub community dominated by saplings; 3.55 acres; TRAM Moderate (50). Photos BPL_4009-11.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 1	
Water Table Present?	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W007

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10X25')				
1. Salix nigra	20	☑	25.0%	OBL
2. Fraxinus pennsylvanica	40	☑	50.0%	FACW
3. Gleditsia triacanthos	20	☑	25.0%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	80	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10X25')				
1. Carex frankii	15	☑	30.0%	OBL
2. Solidago gigantea	15	☑	30.0%	FACW
3. Rumex crispus	5	☐	10.0%	FAC
4. Symphyotrichum lateriflorum var. lateriflorum	15	☑	30.0%	FACW
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	50	= Total Cover		

Woody Vine Stratum (Plot size: 10X25')				
1. Clematis virginiana	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	10	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	35	x 1 =	35	
FACW species	70	x 2 =	140	
FAC species	35	x 3 =	105	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	140	(A)	280	(B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W007

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-2	10YR	4/2	100						Silt Loam	
2-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W008**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.375482 **Long.:** -87.671862 **Datum:** NAD83

Soil Map Unit Name: Linside Silt Loam -- moderately well drained -- occasionaly flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Outer reaches of Wells Creek floodplain south of old field road in southwestern field south of CUF; emergent wetland community containing opportunistic saplings, previous cattle pasture; 0.34 acres; TRAM Moderate (52). Photos BPL_3958-4005.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W008

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Gleditsia triacanthos	30	☑	100.0%	FAC
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	30	= Total Cover		

Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Coleataenia rigidula	20	☑	50.0%	FACW
2. Festuca arundinacea	15	☑	37.5%	FACU
3. Rumex crispus	5	☐	12.5%	FAC
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	40	= Total Cover		

Woody Vine Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	66.7%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	20	x 2 =	40	
FAC species	35	x 3 =	105	
FACU species	15	x 4 =	60	
UPL species	0	x 5 =	0	
Column Totals:	70	(A)	205	(B)

Prevalence Index = B/A = 2.929

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W008

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/3	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W009**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.375129 **Long.:** -87.670727 **Datum:** NAD83

Soil Map Unit Name: Linside Silt Loam -- moderately well drained -- occasionaly flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Outer reaches of Wells Creek floodplain south of old field road in southwestern field south of CUF; emergent wetland community, previous cattle pasture; 3.25 acres; TRAM Moderate (52). Photos BPL_3958-4005.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W009

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1. Gleditsia triacanthos	15	☑	100.0%	FAC
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	15	= Total Cover		

Herb Stratum (Plot size: 10X25')				
1. Elymus virginicus	10	☐	10.0%	FACW
2. Solidago gigantea	15	☑	15.0%	FACW
3. Microstegium vimineum	15	☑	15.0%	FAC
4. Carex festucacea	15	☑	15.0%	FAC
5. Rubus argutus	15	☑	15.0%	FACU
6. Carex frankii	10	☐	10.0%	OBL
7. Rumex crispus	5	☐	5.0%	FAC
8. Carex lurida	15	☑	15.0%	OBL
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		

Woody Vine Stratum (Plot size: 10X25')				
1. Clematis virginiana	10	☑	66.7%	FAC
2. Vitis riparia	5	☑	33.3%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	15	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	8	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	87.5%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	25	x 1 =	25
FACW species	30	x 2 =	60
FAC species	60	x 3 =	180
FACU species	15	x 4 =	60
UPL species	0	x 5 =	0
Column Totals:	130	(A)	325 (B)

Prevalence Index = B/A = 2.500

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W009

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/3	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W010-DP1**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.376980 **Long.:** -87.670543 **Datum:** NAD83

Soil Map Unit Name: Linside Silt Loam -- moderately well drained -- occasionaly flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Wells Creek floodplain south of old field road in southwestern field south of CUF; large wetland complex totals 18.46 acre; contains emergent (DP1), forested (DP2), and successional scrub-shrub habitats (DP3), previous cattle pasture;TRAM Moderate (52). Photos BPL_3958-4005.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 6	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W010-DP1

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10X25')				
1. Carex tribuloides	15	☑	17.6%	FACW
2. Carex festucacea	15	☑	17.6%	FAC
3. Bidens aristosa	15	☑	17.6%	FACW
4. Carex frankii	5	☐	5.9%	OBL
5. Carex lurida	15	☑	17.6%	OBL
6. Coleataenia rigidula	15	☑	17.6%	FACW
7. Rumex crispus	5	☐	5.9%	FAC
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	85	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20	
FACW species	45	x 2 =	90	
FAC species	20	x 3 =	60	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	85	(A)	170	(B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W010-DP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/3	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W010-DP2**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.376960 **Long.:** -87.672771 **Datum:** NAD83

Soil Map Unit Name: Linside Silt Loam -- moderately well drained -- occasionaly flooded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Wells Creek floodplain south of old field road in southwestern field south of CUF; large wetland complex totals 18.46 acre; contains emergent (DP1), forested tree lines (DP2, souther most tree line, representative), and SS habitats (DP3); TRAM Moderate (52). Photos BPL_3958-4005.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 1	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 6	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W010-DP2

Tree Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis laevigata	60	☑	80.0%	FACW
2. Quercus michauxii	15	☑	20.0%	FACW
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	75	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10X25')				
1. Fraxinus pennsylvanica	10	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10X25')				
1. Elymus virginicus	10	☑	50.0%	FACW
2. Microstegium vimineum	10	☑	50.0%	FAC
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	20	= Total Cover		

Woody Vine Stratum (Plot size: 10X25')				
1. Campsis radicans	3	☐	100.0%	FAC
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	3	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	95	x 2 =	190	
FAC species	13	x 3 =	39	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	108	(A)	229	(B)

Prevalence Index = B/A = 2.120

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W010-DP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/3	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W010-DP3**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.380781 **Long.:** -87.671391 **Datum:** NAD83

Soil Map Unit Name: Linside Silt Loam -- moderately well drained -- occasionaly flooded **NWI classification:** PSS1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Wells Creek floodplain south of old field road in southwestern field south of CUF; large wetland complex totals 18.46 acre; contains emergent (DP1), forested tree lines (DP2), and successional scrub-shrub habitas (DP3); TRAM Moderate (52). Photos BPL_3958-4005.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	3
Water Table Present?	Yes ◉ No ○	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W010-DP3

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 15X25')				
1. Fraxinus pennsylvanica	40	☑	44.4%	FACW
2. Salix nigra	30	☑	33.3%	OBL
3. Gleditsia triacanthos	20	☑	22.2%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	90	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10X25')				
1. Carex festucacea	10	☑	33.3%	FAC
2. Carex lurida	10	☑	33.3%	OBL
3. Rubus argutus	10	☑	33.3%	FACU
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		

Woody Vine Stratum (Plot size: 10X25')			
1.		☐	0.0%
2.		☐	0.0%
3.	0	☐	0.0%
4.	0	☐	0.0%
5.	0	☐	0.0%
6.	0	☐	0.0%
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	6	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	83.3%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	40	x 1 =	40
FACW species	40	x 2 =	80
FAC species	30	x 3 =	90
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	120 (A)		250 (B)

Prevalence Index = B/A = 2.083

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W010-DP3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011a**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.380790 **Long.:** -87.663574 **Datum:** NAD83

Soil Map Unit Name: Armour silt loam, 5-12% slopes, eroded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011a emergent wetland adjacent to open water, partly in ROW. FPH_Photos#DSCN5459 1.86 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011a

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Fraxinus pennsylvanica	10	☑	50.0%	FACW
2. Cephalanthus occidentalis	10	☑	50.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	10	☑	17.2%	FACW
2. Juncus effusus	10	☑	17.2%	FACW
3. Carex frankii	8	☐	13.8%	OBL
4. Microstegium vimineum	10	☑	17.2%	FAC
5. Lysimachia nummularia	10	☑	17.2%	FACW
6. Leersia oryzoides	10	☑	17.2%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	58	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	28	x 1 =	28
FACW species	40	x 2 =	80
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	78 (A)		138 (B)

Prevalence Index = B/A = 1.769

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011b**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** ____ **T** ____ **R** ____

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.382308 **Long.:** -87.665254 **Datum:** NAD83

Soil Map Unit Name: Gumdale silt loam, rarely flooded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011b forested wetland peninsula. FPH_Photos#DSCN5457 9.03 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011b

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Fraxinus pennsylvanica	20	☑	20.0%	FACW
2. Celtis laevigata	20	☑	20.0%	FACW
3. Liriodendron tulipifera	20	☑	20.0%	FACU
4. Platanus occidentalis	20	☑	20.0%	FACW
5. Salix nigra	20	☑	20.0%	OBL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	100	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	10	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	10	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	11	(A)
Total Number of Dominant Species Across All Strata:	12	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	91.7%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	40	x 1 =	40
FACW species	75	x 2 =	150
FAC species	5	x 3 =	15
FACU species	20	x 4 =	80
UPL species	0	x 5 =	0
Column Totals:	140	(A)	285 (B)

Prevalence Index = B/A = 2.036

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011c**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.379365 **Long.:** -87.664874 **Datum:** NAD83

Soil Map Unit Name: Maury silty clay loam, 12-20% slopes, eroded **NWI classification:** PFO1N

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011c forested wetland regularly flooded. FPH_Photos#DSCN5463. 1.05 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	6
Water Table Present?	Yes ◉ No ○	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011c

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Fraxinus pennsylvanica	20	☑	20.0%	FACW
2. Celtis laevigata	20	☑	20.0%	FACW
3. Taxodium distichum	10	☐	10.0%	OBL
4. Platanus occidentalis	20	☑	20.0%	FACW
5. Salix nigra	30	☑	30.0%	OBL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	100	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	10	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	10	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	11	(A)
Total Number of Dominant Species Across All Strata:	11	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species	75	x 2 =	150
FAC species	5	x 3 =	15
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	140 (A)		225 (B)

Prevalence Index = B/A = 1.607

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011c

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011d**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.379614 **Long.:** -87.665534 **Datum:** NAD83

Soil Map Unit Name: Water **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011d emergent wetland adjacent to open water. FPH_Photos#DSCN5464. 0.17 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011d

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Fraxinus pennsylvanica	10	☑	50.0%	FACW
2. Cephalanthus occidentalis	10	☑	50.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	10	☑	17.2%	FACW
2. Juncus effusus	10	☑	17.2%	FACW
3. Carex frankii	8	☐	13.8%	OBL
4. Microstegium vimineum	10	☑	17.2%	FAC
5. Lysimachia nummularia	10	☑	17.2%	FACW
6. Leersia oryzoides	10	☑	17.2%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	58	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	28	x 1 =	28	
FACW species	40	x 2 =	80	
FAC species	10	x 3 =	30	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	78	(A)	138	(B)

Prevalence Index = B/A = 1.769

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011d

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011e**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.380107 **Long.:** -87.666057 **Datum:** NAD83

Soil Map Unit Name: Gumdale silt loam, rarely flooded **NWI classification:** PFO1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011e forested wetland fringe to open water, regularly flooded. FPH_Photos#DSCN5463. 0.51 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 6	
Water Table Present?	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011e

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Fraxinus pennsylvanica	20	☑	23.5%	FACW
2. Celtis laevigata	20	☑	23.5%	FACW
3. Taxodium distichum	10	☐	11.8%	OBL
4. Platanus occidentalis	5	☐	5.9%	FACW
5. Salix nigra	30	☑	35.3%	OBL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	85	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	30	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	30	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	10	(A)
Total Number of Dominant Species Across All Strata:	10	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	80	x 1 =	80	
FACW species	60	x 2 =	120	
FAC species	5	x 3 =	15	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	145	(A)	215	(B)

Prevalence Index = B/A = 1.483

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011e

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011f**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.380875 **Long.:** -87.665746 **Datum:** NAD83

Soil Map Unit Name: Gumdale silt loam, rarely flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ◉ No ○		
Hydric Soil Present? Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○	
Wetland Hydrology Present? Yes ◉ No ○		

Remarks:

W011f emergent wetland adjacent to open water, in ROW. FPH_Photos#DSCN5462 0.99 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011f

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Fraxinus pennsylvanica	10	☑	50.0%	FACW
2. Cephalanthus occidentalis	10	☑	50.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	10	☑	17.2%	FACW
2. Juncus effusus	10	☑	17.2%	FACW
3. Carex frankii	8	☐	13.8%	OBL
4. Microstegium vimineum	10	☑	17.2%	FAC
5. Lysimachia nummularia	10	☑	17.2%	FACW
6. Leersia oryzoides	10	☑	17.2%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	58	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	28	x 1 =	28	
FACW species	40	x 2 =	80	
FAC species	10	x 3 =	30	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	78	(A)	138	(B)

Prevalence Index = B/A = 1.769

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011f

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011g**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Lowland **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.380312 **Long.:** -87.667796 **Datum:** NAD83

Soil Map Unit Name: Lindside silt loam, occasionally flooded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011g forested wetland depression saturated. FPH_Photos#DSCN5474. 2.66 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ◉ No ○	Depth (inches):	-4
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011g

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Fraxinus pennsylvanica	20	☑	21.1%	FACW
2. Celtis laevigata	20	☑	21.1%	FACW
3. Taxodium distichum	5	☐	5.3%	OBL
4. Platanus occidentalis	10	☐	10.5%	FACW
5. Salix nigra	40	☑	42.1%	OBL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	95	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	7	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	7	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	10	(A)
Total Number of Dominant Species Across All Strata:	10	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	62	x 1 =	62	
FACW species	65	x 2 =	130	
FAC species	5	x 3 =	15	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	132	(A)	207	(B)

Prevalence Index = B/A = 1.568

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011g

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011h**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.380862 **Long.:** -87.667329 **Datum:** NAD83

Soil Map Unit Name: Water **NWI classification:** PSS1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011h scrub shrub wetland fringe to open water, regularly flooded. FPH_Photos#DSCN5475. 2.39 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	6
Water Table Present?	Yes ◉ No ○	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011h

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Salix nigra	40	☑	57.1%	OBL
2. Fraxinus pennsylvanica	30	☑	42.9%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	70	= Total Cover		
Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	30	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	30	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	9	(A)
Total Number of Dominant Species Across All Strata:	9	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	80	x 1 =	80
FACW species	45	x 2 =	90
FAC species	5	x 3 =	15
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	130 (A)		185 (B)

Prevalence Index = B/A = 1.423

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011h

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011i**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.380585 **Long.:** -87.668792 **Datum:** NAD83

Soil Map Unit Name: Gumdale silt loam, rarely flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011i emergent wetland adjacent to open water anf forested/scrubshrub wetland.1.40 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011i

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Fraxinus pennsylvanica	10	☑	50.0%	FACW
2. Cephalanthus occidentalis	10	☑	50.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	10	☑	17.2%	FACW
2. Juncus effusus	10	☑	17.2%	FACW
3. Carex frankii	8	☐	13.8%	OBL
4. Microstegium vimineum	10	☑	17.2%	FAC
5. Lysimachia nummularia	10	☑	17.2%	FACW
6. Leersia oryzoides	10	☑	17.2%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	58	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	28	x 1 =	28	
FACW species	40	x 2 =	80	
FAC species	10	x 3 =	30	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	78	(A)	138	(B)

Prevalence Index = B/A = 1.769

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011i

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011j**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Lowland **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.381321 **Long.:** -87.670396 **Datum:** NAD83

Soil Map Unit Name: Lindside silt loam, occasionally flooded **NWI classification:** PFO1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011j forested wetland , 1-3 feet of standing water. FPH_Photos#DSCN5428. 6.87 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☑ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 18	
Water Table Present?	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011i

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Fraxinus pennsylvanica	5	☐	5.3%	FACW
2. Celtis laevigata	5	☐	5.3%	FACW
3. Taxodium distichum	50	☑	52.6%	OBL
4. Platanus occidentalis	5	☐	5.3%	FACW
5. Salix nigra	30	☑	31.6%	OBL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	95	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	30	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	30	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	9	(A)
Total Number of Dominant Species Across All Strata:	9	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	120	x 1 =	120	
FACW species	30	x 2 =	60	
FAC species	5	x 3 =	15	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	155	(A)	195	(B)

Prevalence Index = B/A = 1.258

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011j

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011k**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.382629 **Long.:** -87.671013 **Datum:** NAD83

Soil Map Unit Name: Lindside silt loam, occasionally flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011k emergent wetland connects to forested wetland complex. FPH_Photos#DSCN5430. 2.12 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011k

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Fraxinus pennsylvanica	10	☑	50.0%	FACW
2. Cephalanthus occidentalis	10	☑	50.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	10	☑	17.2%	FACW
2. Juncus effusus	10	☑	17.2%	FACW
3. Carex frankii	8	☐	13.8%	OBL
4. Microstegium vimineum	10	☑	17.2%	FAC
5. Lysimachia nummularia	10	☑	17.2%	FACW
6. Leersia oryzoides	10	☑	17.2%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	58	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	28	x 1 =	28	
FACW species	40	x 2 =	80	
FAC species	10	x 3 =	30	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	78	(A)	138	(B)

Prevalence Index = B/A = 1.769

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011k

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011l**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.382050 **Long.:** -87.669407 **Datum:** NAD83

Soil Map Unit Name: Water **NWI classification:** PSS1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011l scrub shrub wetland fringe to open water, regularly flooded. FPH_Photos#DSCN5433. 2.15 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	6
Water Table Present?	Yes ◉ No ○	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011I

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Salix nigra	40	☑	57.1%	OBL
2. Fraxinus pennsylvanica	30	☑	42.9%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	70	= Total Cover		
Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	30	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	30	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	9	(A)
Total Number of Dominant Species Across All Strata:	9	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	80	x 1 =	80	
FACW species	45	x 2 =	90	
FAC species	5	x 3 =	15	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	130	(A)	185	(B)

Prevalence Index = B/A = 1.423

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011I

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011m**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.383256 **Long.:** -87.669114 **Datum:** NAD83

Soil Map Unit Name: Water **NWI classification:** PSS1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011m scrub shrub wetland fringe to open water,in ROW. FPH_Photos#DSCN5438. 0.35 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 6	
Water Table Present?	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011m

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0		= Total Cover	

Sapling-Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Salix nigra	5	☑	50.0%	OBL
2. Fraxinus pennsylvanica	5	☑	50.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10		= Total Cover	

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Cephalanthus occidentalis	40	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	40		= Total Cover	

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30		= Total Cover	

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	9	(A)
Total Number of Dominant Species Across All Strata:	9	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	55	x 1 =	55	
FACW species	20	x 2 =	40	
FAC species	5	x 3 =	15	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	80	(A)	110	(B)

Prevalence Index = B/A = 1.375

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011m

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011n**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.385202 **Long.:** -87.668093 **Datum:** NAD83

Soil Map Unit Name: Water **NWI classification:** PSS1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011n scrub shrub wetland fringe to open water, regularly flooded. FPH_Photos#DSCN5441. 1.36 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 6	
Water Table Present?	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011n

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Salix nigra	40	☑	57.1%	OBL
2. Fraxinus pennsylvanica	30	☑	42.9%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	70	= Total Cover		
Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	30	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	30	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	9	(A)
Total Number of Dominant Species Across All Strata:	9	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	80	x 1 =	80	
FACW species	45	x 2 =	90	
FAC species	5	x 3 =	15	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	130	(A)	185	(B)

Prevalence Index = B/A = 1.423

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011n

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011o**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Lowland **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.385505 **Long.:** -87.668549 **Datum:** NAD83

Soil Map Unit Name: Melvin silt loam, frequently flooded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011o forested wetland adjacent to open water and scrub shrub fringe. FPH_Photos#DSCN5441. 4.03 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011o

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Fraxinus pennsylvanica	20	☑	21.1%	FACW
2. Celtis laevigata	20	☑	21.1%	FACW
3. Taxodium distichum	5	☐	5.3%	OBL
4. Platanus occidentalis	10	☐	10.5%	FACW
5. Salix nigra	40	☑	42.1%	OBL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	95	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	7	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	7	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	10	(A)
Total Number of Dominant Species Across All Strata:	10	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	62	x 1 =	62	
FACW species	65	x 2 =	130	
FAC species	5	x 3 =	15	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	132	(A)	207	(B)

Prevalence Index = B/A = 1.568

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011o

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011p**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.385728 **Long.:** -87.669049 **Datum:** NAD83

Soil Map Unit Name: Melvin silt loam, frequently flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011p emergent wetland saturated adjacent to open water and forested/scrubshrub wetland, in ROW. FPH_Photo#DSCN5444. 0.67 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☑ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ◉ No ○	Depth (inches): -4	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011p

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Fraxinus pennsylvanica	5	☑	20.0%	FACW
2. Cephalanthus occidentalis	20	☑	80.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	25	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	8	(A)
Total Number of Dominant Species Across All Strata:	8	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	30	x 1 =	30	
FACW species	20	x 2 =	40	
FAC species	5	x 3 =	15	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	55	(A)	85	(B)

Prevalence Index = B/A = 1.545

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011p

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011q**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.385742 **Long.:** -87.669379 **Datum:** NAD83

Soil Map Unit Name: Melvin silt loam, frequently flooded **NWI classification:** PSS1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011q scrub shrub wetland fringe to open water, regularly flooded. FPH_Photos#DSCN5444. 0.70 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	6
Water Table Present?	Yes ◉ No ○	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011g

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Salix nigra	5	☑	50.0%	OBL
2. Fraxinus pennsylvanica	5	☑	50.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10		= Total Cover	
Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	40	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	40		= Total Cover	
Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30		= Total Cover	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 9 (A)

Total Number of Dominant Species Across All Strata: 9 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	55	x 1 =	55
FACW species	20	x 2 =	40
FAC species	5	x 3 =	15
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	80 (A)		110 (B)

Prevalence Index = B/A = 1.375

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011q

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011r**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Lowland **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.386467 **Long.:** -87.669395 **Datum:** NAD83

Soil Map Unit Name: Melvin silt loam, frequently flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011r emergent wetland saturated connected to forested wetland complex, in ROW. Adjacent to standing water, staurated. FPH_Photo#DSCN5445. 2.33 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☑ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ◉ No ○	Depth (inches):	-4
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011r

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Fraxinus pennsylvanica	5	☑	38.5%	FACW
2. Cephalanthus occidentalis	8	☑	61.5%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	13	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	10	☑	12.5%	FACW
2. Juncus effusus	10	☑	12.5%	FACW
3. Carex frankii	10	☑	12.5%	OBL
4. Microstegium vimineum	20	☑	25.0%	FAC
5. Lysimachia nummularia	20	☑	25.0%	FACW
6. Leersia oryzoides	10	☑	12.5%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	80	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	8	(A)
Total Number of Dominant Species Across All Strata:	8	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	28	x 1 =	28	
FACW species	45	x 2 =	90	
FAC species	20	x 3 =	60	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	93	(A)	178	(B)

Prevalence Index = B/A = 1.914

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011r

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011s**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387614 **Long.:** -87.669184 **Datum:** NAD83

Soil Map Unit Name: Maury/Melvin Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of large, extensive wetland floodplain along Wells Creek west of CUF; W011s is the emergent wetland habitat located in a TVA ROW, recently herbicided; TRAM Moderate (65). Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches): 3	
Water Table Present?	Yes ○ No ◉	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011s

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10' radius')				
1. Carex vulpinoidea	15	☑	18.8%	OBL
2. Iva annua	30	☑	37.5%	FAC
3. Liquidambar styraciflua	10	☐	12.5%	FAC
4. Lespedeza cuneata	10	☐	12.5%	FACU
5. Carex frankii	15	☑	18.8%	OBL
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	80	= Total Cover		

Woody Vine Stratum (Plot size: 10X25')				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	30	x 1 =	30
FACW species	0	x 2 =	0
FAC species	40	x 3 =	120
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	80	(A)	190 (B)

Prevalence Index = B/A = 2.375

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011s

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-4	10YR	4/3	100						Silt Loam	
4-12+	10YR	4/2	80	10YR	5/4	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011t-DP1**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387678 **Long.:** -87.670040 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of large, extensive wetland floodplain along Wells Creek west of CUF; W011t is a forested portion, W011t DP1 represents the forested portion near the new road and Wells Ck Bridge where trees are younger; TRAM Moderate (65). Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	3
Water Table Present?	Yes ○ No ◉	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011t-DP1

Tree Stratum (Plot size: 25' radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	40	☑	36.4%	FACW
2. Liquidambar styraciflua	40	☑	36.4%	FAC
3. Fraxinus pennsylvanica	20	☐	18.2%	FACW
4. Juniperus virginiana	10	☐	9.1%	FACU
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	110	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10' radius')				
1. Carex tribuloides	40	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	40	= Total Cover		

Woody Vine Stratum (Plot size: 10X25')				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	40	x 3 =	120
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	150 (A)		360 (B)

Prevalence Index = B/A = 2.400

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011t-DP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-4	10YR	4/3	100						Silt Loam	
4-12+	10YR	4/2	80	10YR	5/4	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011t-DP2**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.385819 **Long.:** -87.670428 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of large, extensive wetland floodplain along Scotts Branch/Wells Creek confluence west of CUF; W011t is a forested portion, W011t DP2 represents mature forest near Scotts Branch @ Wells Creek; TRAM Moderate (65); Photos BPL_iPad

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 2	
Water Table Present?	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011t-DP2

Tree Stratum (Plot size: 50' radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	20	☑	22.2%	FACW
2. Liquidambar styraciflua	20	☑	22.2%	FAC
3. Quercus nigra	20	☑	22.2%	FAC
4. Taxodium distichum	20	☑	22.2%	OBL
5. Juniperus virginiana	10	☐	11.1%	FACU
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	90	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10' radius')				
1. Carex tribuloides	15	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	15	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	20	x 1 =	20	
FACW species	35	x 2 =	70	
FAC species	40	x 3 =	120	
FACU species	10	x 4 =	40	
UPL species	0	x 5 =	0	
Column Totals:	105	(A)	250	(B)

Prevalence Index = B/A = 2.381

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011t-DP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-2	10YR	4/2	100						Silt Loam	
2-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011t-DP3**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387102 **Long.:** -87.674832 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of large, extensive wetland floodplain along Scotts Branch/Wells Creek confluence west of CUF; W011t is a forested portion, W011t-DP3 represents mature forest the west end of Scotts Branch in this complex; TRAM Moderate (65); Photos BPL_iPad

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches): ____	
Water Table Present?	Yes ○ No ◉	Depth (inches): ____	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011t-DP3

Tree Stratum (Plot size: 50' radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis laevigata	20	☑	22.2%	FACW
2. Populus deltoides	10	☐	11.1%	FAC
3. Quercus nigra	20	☑	22.2%	FAC
4. Quercus phellos	20	☑	22.2%	FAC
5. Fraxinus pennsylvanica	10	☐	11.1%	FACW
6. Salix nigra	10	☐	11.1%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	90	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10' radius')				
1. Microstegium vimineum	15	☑	50.0%	FAC
2. Tradescantia virginiana	15	☑	50.0%	FACU
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 80.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	10	x 1 =	10
FACW species	30	x 2 =	60
FAC species	65	x 3 =	195
FACU species	15	x 4 =	60
UPL species	0	x 5 =	0
Column Totals:	120	(A)	325 (B)

Prevalence Index = B/A = 2.708

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011t-DP3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-2	10YR	4/2	100						Silt Loam	
2-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011u**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Lowland **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.385574 **Long.:** -87.671901 **Datum:** NAD83

Soil Map Unit Name: Melvin silt loam, frequently flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011u emergent wetland field connected to forested wetland complex. FPH_Photo#DSCN5448. 1.33 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011u

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Fraxinus pennsylvanica	15	☑	75.0%	FACW
2. Cephalanthus occidentalis	5	☑	25.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		

Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size:)				
1. Impatiens capensis	10	☐	10.0%	FACW
2. Juncus effusus	10	☐	10.0%	FACW
3. Carex frankii	10	☐	10.0%	OBL
4. Microstegium vimineum	20	☑	20.0%	FAC
5. Lysimachia nummularia	20	☑	20.0%	FACW
6. Leersia oryzoides	30	☑	30.0%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	45	x 1 =	45
FACW species	55	x 2 =	110
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	120 (A)		215 (B)

Prevalence Index = B/A = 1.792

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011u

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011v**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** ____ **T** ____ **R** ____

Landform (hillslope, terrace, etc.): Lowland **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.386439 **Long.:** -87.674137 **Datum:** NAD83

Soil Map Unit Name: Lindside silt loam, occasionally flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011v emergent wetland field connected to forested wetland complex. 0.32 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011v

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Fraxinus pennsylvanica	15	☑	75.0%	FACW
2. Cephalanthus occidentalis	5	☑	25.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	10	☐	10.0%	FACW
2. Juncus effusus	10	☐	10.0%	FACW
3. Carex frankii	10	☐	10.0%	OBL
4. Microstegium vimineum	20	☑	20.0%	FAC
5. Lysimachia nummularia	20	☑	20.0%	FACW
6. Leersia oryzoides	30	☑	30.0%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	45	x 1 =	45	
FACW species	55	x 2 =	110	
FAC species	20	x 3 =	60	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	120	(A)	215	(B)

Prevalence Index = B/A = 1.792

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011v

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011w**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387464 **Long.:** -87.676069 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of large, extensive wetland floodplain along Scotts Branch/Wells Creek confluence west of CUF; W011w is an emergent portion, 0.79 acre; TRAM Moderate (65); Photos BPL_ iPad. Disturbance evident.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011w

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: 15' radius)				
1. Cephalanthus occidentalis	5	☑	100.0%	OBL
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	5	= Total Cover		

Herb Stratum (Plot size: 15' radius)				
1. Apios americana	15	☑	15.0%	FACW
2. Vernonia gigantea	10	☑	10.0%	FAC
3. Carex vulpinoidea	10	☑	10.0%	OBL
4. Carex frankii	10	☑	10.0%	OBL
5. Scirpus cyperinus	5	☐	5.0%	FACW
6. Solidago gigantea	10	☑	10.0%	FACW
7. Paspalum laeve	10	☑	10.0%	FAC
8. Panicum anceps	15	☑	15.0%	FAC
9. Scirpus atrovirens	10	☑	10.0%	OBL
10. Cicuta maculata	5	☐	5.0%	OBL
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	9	(A)
Total Number of Dominant Species Across All Strata:	9	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40	
FACW species	30	x 2 =	60	
FAC species	35	x 3 =	105	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	105	(A)	205	(B)

Prevalence Index = B/A = 1.952

Hydrophytic Vegetation Indicators:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☑ Dominance Test is > 50%
- ☑ Prevalence Index is ≤3.0 [1]
- ☐ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011w

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-2	10YR	4/2	100						Silt Loam	
2-12	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	12+ = gravel

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 28-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011x**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388032 **Long.:** -87.674863 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PSS1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of large, extensive wetland floodplain along Scotts Branch/Wells Creek confluence west of CUF; W011x is a successional scrub-shrub portion, 1.09 acre; TRAM Moderate (65); Photos BPL_ iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011x

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15' radius)				
1. Fraxinus pennsylvanica	60	☑	85.7%	FACW
2. Salix nigra	10	☐	14.3%	OBL
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	70	= Total Cover		
Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15' radius)				
1. Festuca arundinacea	10	☑	11.8%	FACU
2. Vernonia gigantea	10	☑	11.8%	FAC
3. Rubus argutus	10	☑	11.8%	FACU
4. Carex lurida	10	☑	11.8%	OBL
5. Ptilimnium capillaceum	20	☑	23.5%	OBL
6. Ambrosia trifida	10	☑	11.8%	FAC
7. Rosa palustris	10	☑	11.8%	OBL
8. Ambrosia artemisiifolia	5	☐	5.9%	FACU
9.		☐	0.0%	
10.		☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	85	= Total Cover		
Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	6	(A)
Total Number of Dominant Species Across All Strata:	8	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	75.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	50	x 1 =	50
FACW species	60	x 2 =	120
FAC species	20	x 3 =	60
FACU species	25	x 4 =	100
UPL species	0	x 5 =	0
Column Totals:	155	(A)	330 (B)

Prevalence Index = B/A = 2.129

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011x

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-4	10YR	4/2	100						Silt Loam	
4-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 27-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011y**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388053 **Long.:** -87.675065 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of large, extensive wetland floodplain along Scotts Branch/Wells Creek confluence west of CUF; W011y is an emergent portion, 0.24 acre; TRAM Moderate (65); Photos BPL_ iPad. Mowed.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011y

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 15' radius)				
1. Solidago gigantea	10	☑	11.1%	FACW
2. Vernonia gigantea	10	☑	11.1%	FAC
3. Rubus argutus	10	☑	11.1%	FACU
4. Carex lurida	10	☑	11.1%	OBL
5. Ptilimnium capillaceum	15	☑	16.7%	OBL
6. Hymenocallis occidentalis var. occidentalis	5	☐	5.6%	OBL
7. Rosa palustris	10	☑	11.1%	OBL
8. Ambrosia artemisiifolia	10	☑	11.1%	FACU
9. Festuca arundinacea	10	☑	11.1%	FACU
10.		☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	90	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 62.5% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	40	x 1 =	40
FACW species	10	x 2 =	20
FAC species	10	x 3 =	30
FACU species	30	x 4 =	120
UPL species	0	x 5 =	0
Column Totals:	90	(A)	210 (B)

Prevalence Index = B/A = 2.333

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011y

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-4	10YR	4/2	100						Silt Loam	
4-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W011z**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Shoreline **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.384080 **Long.:** -87.666442 **Datum:** NAD83

Soil Map Unit Name: Gumdale silt loam, rarely flooded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W011z forested wetland island. FPH_Photos#DSCN5438 9.30 acres. TRAM Score = 65 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W011z

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Fraxinus pennsylvanica	20	☑	20.0%	FACW
2. Celtis laevigata	20	☑	20.0%	FACW
3. Liriodendron tulipifera	20	☑	20.0%	FACU
4. Platanus occidentalis	20	☑	20.0%	FACW
5. Salix nigra	20	☑	20.0%	OBL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	100	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	10	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	10	= Total Cover		

Herb Stratum (Plot size:)				
1. Impatiens capensis	5	☑	16.7%	FACW
2. Juncus effusus	5	☑	16.7%	FACW
3. Carex frankii	5	☑	16.7%	OBL
4. Microstegium vimineum	5	☑	16.7%	FAC
5. Lysimachia nummularia	5	☑	16.7%	FACW
6. Leersia oryzoides	5	☑	16.7%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	11	(A)
Total Number of Dominant Species Across All Strata:	12	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	91.7%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	40	x 1 =	40
FACW species	75	x 2 =	150
FAC species	5	x 3 =	15
FACU species	20	x 4 =	80
UPL species	0	x 5 =	0
Column Totals:	140	(A)	285 (B)

Prevalence Index = B/A = 2.036

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W011z

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W012**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387668 **Long.:** -87.667996 **Datum:** NAD83

Soil Map Unit Name: Maury silty clay loam, 5-12% slopes, eroded **NWI classification:** PFO1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W012 forested wetland on edge of open water to east, saturated, regular flooding. ROW adjacent to west. FPH_Photo#DSCN5467. 1.11 acres. TRAM Score = 51 (Moderate).

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ◉ No ○	Depth (inches): -4	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W012

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Taxodium distichum	30	☑	37.5%	OBL
2. Salix nigra	30	☑	37.5%	OBL
3. Celtis laevigata	20	☑	25.0%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	80	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Cephalanthus occidentalis	5	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	5	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	65	x 1 =	65
FACW species	20	x 2 =	40
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	85 (A)		105 (B)

Prevalence Index = B/A = 1.235

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W012

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-18	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W013a**

Investigator(s): Britta Lees/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Drain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387345 **Long.:** -87.676414 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:
Wetland drain feeding Scotts Branch, west of CUF; 0.07 acre; TRAM Low (27); no photos.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches): 2
Water Table Present?	Yes ○	No ◉	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W013a

Tree Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis laevigata	40	☑	50.0%	FACW
2. Platanus occidentalis	20	☑	25.0%	FACW
3. Liquidambar styraciflua	20	☑	25.0%	FAC
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	80	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size: 10X25')				
1. Lonicera japonica	10	☑	50.0%	FACU
2. Campsis radicans	10	☑	50.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	20	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	80.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	60	x 2 =	120	
FAC species	30	x 3 =	90	
FACU species	10	x 4 =	40	
UPL species	0	x 5 =	0	
Column Totals:	100	(A)	250	(B)

Prevalence Index = B/A = 2.500

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W013a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-6	10YR	4/3	100						Silt Loam	
6-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W013b**

Investigator(s): Britta Lees/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Drain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387187 **Long.:** -87.676720 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:
Wetland drain feeding Scotts Branch, emergent portion adjacent to forested W013a; west of CUF; 0.04 acre; TRAM Low (27); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches): 2
Water Table Present?	Yes ○	No ◉	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W013b

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5'X15')				
1. Impatiens capensis	5	☐	6.7%	FACW
2. Persicaria maculosa	10	☐	13.3%	FACW
3. Cyperus strigosus	15	☑	20.0%	FACW
4. Chasmanthium latifolium	15	☑	20.0%	FACU
5. Ludwigia palustris	30	☑	40.0%	OBL
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	75	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	66.7%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	30	x 1 =	30
FACW species	30	x 2 =	60
FAC species	0	x 3 =	0
FACU species	15	x 4 =	60
UPL species	0	x 5 =	0
Column Totals:	75	(A)	150 (B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W013b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-6	10YR	4/3	100						Silt Loam	
6-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W014**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388032 **Long.:** -87.674863 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PSS1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of large, wetland floodplain northwest of new road along Scotts Branch west of CUF; 1.11 acre; TRAM Low (39); Photos BPL_ iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W014

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1. Cephalanthus occidentalis	40	☑	44.4%	OBL
2. Fraxinus pennsylvanica	30	☑	33.3%	FACW
3. Rubus argutus	10	☐	11.1%	FACU
4. Acer negundo	10	☐	11.1%	FAC
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	90	= Total Cover		

Herb Stratum (Plot size: 15' radius)				
1. Carex lurida	15	☑	100.0%	OBL
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.		☐	0.0%	
10.		☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	15	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	55	x 1 =	55	
FACW species	30	x 2 =	60	
FAC species	10	x 3 =	30	
FACU species	10	x 4 =	40	
UPL species	0	x 5 =	0	
Column Totals:	105	(A)	185	(B)

Prevalence Index = B/A = 1.762

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W014

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/3	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 27-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W015**

Investigator(s): Britta Lees/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387733 **Long.:** -87.678419 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Seepage wetland feeding Scotts Branch; west of CUF site; 0.14 acre; TRAM Low (41); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	1
Water Table Present?	Yes ◉ No ○	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Site visit in 2014 with local land owner at the time stated the area was spring fed; land owner stated the old barn present was part of an old homestead -- the home had been removed by 2014.

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W015

Tree Stratum (Plot size: 15' radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Salix nigra	15	☑	23.1%	OBL
2. Ulmus americana	30	☑	46.2%	FACW
3. Fraxinus pennsylvanica	10	☐	15.4%	FACW
4. Platanus occidentalis	10	☐	15.4%	FACW
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	65	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 15' radius)				
1. Salix nigra	10	☑	33.3%	OBL
2. Acer rubrum	10	☑	33.3%	FAC
3. Cornus racemosa	10	☑	33.3%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	30	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5'X15')				
1. Impatiens capensis	20	☑	28.6%	FACW
2. Mentha arvensis	10	☑	14.3%	FACW
3. Elymus virginicus	5	☐	7.1%	FACW
4. Commelina virginica	15	☑	21.4%	FACW
5. Typha latifolia	10	☑	14.3%	OBL
6. Solidago gigantea	10	☑	14.3%	FACW
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	70	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 10 (A)

Total Number of Dominant Species Across All Strata: 10 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	35	x 1 =	35	
FACW species	110	x 2 =	220	
FAC species	20	x 3 =	60	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	165	(A)	315	(B)

Prevalence Index = B/A = 1.909

Hydrophytic Vegetation Indicators:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☑ Dominance Test is > 50%
- ☑ Prevalence Index is ≤3.0 [1]
- ☐ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W015

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	5/2	100						Silt Loam	
3-12+	10YR	5/1	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 30-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W016**

Investigator(s): Britta Lees/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Depression **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388015 **Long.:** -87.680030 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:
Depression along Old Scotts Road; west of CUF site; 0.03 acre; TRAM Low (30); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☑ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W016

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5'X5')				
1. Scirpus atrovirens	30	☑	33.3%	OBL
2. Symphotricium novae-angliae	20	☑	22.2%	FACW
3. Commelina virginica	5	☐	5.6%	FACW
4. Vernonia gigantea	5	☐	5.6%	FAC
5. Coleataenia rigidula	10	☐	11.1%	FACW
6. Iva annua	20	☑	22.2%	FAC
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	90	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	30	x 1 =	30
FACW species	35	x 2 =	70
FAC species	25	x 3 =	75
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	90 (A)		175 (B)

Prevalence Index = B/A = 1.944

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W016

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/3	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 27-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W017a,d**

Investigator(s): Britta Lees/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388303 **Long.:** -87.681026 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of Scotts Creek floodplain, separated from creek by gravel road in wide valley bottom; emergent wetland habitat in W017a and W017d within overhead local distributor electic line ROW, separated by disturbed area; 0.12(a) & 0.27(d) acre; TRAM Low (36); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W017a,d

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5'X10')				
1. Carex lurida	20	☑	25.0%	OBL
2. Solidago gigantea	5	☐	6.3%	FACW
3. Platanus occidentalis	5	☐	6.3%	FACW
4. Liquidambar styraciflua	5	☐	6.3%	FAC
5. Scirpus atrovirens	15	☑	18.8%	OBL
6. Carex vulpinoidea	10	☐	12.5%	OBL
7. Desmodium paniculatum	5	☐	6.3%	FACU
8. Arthraxon hispidus	15	☑	18.8%	FAC
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	80	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	45	x 1 =	45	
FACW species	10	x 2 =	20	
FAC species	20	x 3 =	60	
FACU species	5	x 4 =	20	
UPL species	0	x 5 =	0	
Column Totals:	80	(A)	145	(B)

Prevalence Index = B/A = 1.813

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W017a,d

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 4/1	80	10YR 4/6	20	D	M	Silt Loam	gravel in profile

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 28-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W017b**

Investigator(s): Britta Lees/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388330 **Long.:** -87.681361 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of Scotts Creek floodplain, separated from creek by gravel road in wide valley bottom; linear wetland feature connecting W017a and W017c inundated along roadside, within overhead local distributor electic line ROW; 0.01 acre; TRAM Low (36); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 1	
Water Table Present?	Yes ○ No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W017b

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 2'X5')				
1. Sagittaria latifolia	60	☑	75.0%	OBL
2. Echinochloa crusgalli	20	☑	25.0%	FACU
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	80	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	50.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60	
FACW species	0	x 2 =	0	
FAC species	0	x 3 =	0	
FACU species	20	x 4 =	80	
UPL species	0	x 5 =	0	
Column Totals:	80	(A)	140	(B)

Prevalence Index = B/A = 1.750

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W017b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-6	10YR 5/1	80	10YR 4/6	20	D	M	Silt Loam	6+ = gravel

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 28-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W017c**

Investigator(s): Britta Lees/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388428 **Long.:** -87.681728 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of Scotts Creek floodplain, separated from creek by gravel road in wide valley bottom in TVA 161kV powerline ROW; higly disturbed, earth moving and vehicle traversing evident; 0.11 acre; TRAM Low (36); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☑ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 1	
Water Table Present?	Yes ○ No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W017c

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 2'X5')				
1. Cyperus strigosus	20	☑	25.0%	FACW
2. Carex vulpinoidea	20	☑	25.0%	OBL
3. Lespedeza cuneata	20	☑	25.0%	FACU
4. Commelina virginica	20	☑	25.0%	FACW
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	80	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	75.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	20	x 1 =	20
FACW species	40	x 2 =	80
FAC species	0	x 3 =	0
FACU species	20	x 4 =	80
UPL species	0	x 5 =	0
Column Totals:	80	(A)	180 (B)

Prevalence Index = B/A = 2.250

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W017c

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	80	10YR 4/6	20	D	M	Silt Loam	gravel in profile

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 28-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W017e**

Investigator(s): Britta Lees/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388822 **Long.:** -87.682989 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Part of Scotts Creek floodplain, separated from main creek by gravel road in wide valley bottom, includes drainage feature; forested portion outside of emergent area in ROW; 0.59 acre; TRAM Low (36); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W017e

Tree Stratum (Plot size: 10X25')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	30	☑	40.0%	FACW
2. Acer negundo	15	☑	20.0%	FAC
3. Liquidambar styraciflua	30	☑	40.0%	FAC
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	75	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10X25')				
1. Lindera benzoin	15	☑	100.0%	FAC
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	15	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 2'X5')				
1. Microstegium vimineum	15	☑	100.0%	FAC
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	15	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	30	x 2 =	60	
FAC species	75	x 3 =	225	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	105	(A)	285	(B)

Prevalence Index = B/A = 2.714

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W017e

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/2	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 28-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W018a**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Lowland **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388880 **Long.:** -87.684153 **Datum:** NAD83

Soil Map Unit Name: Humphreys gravelly silt loam, 2-5% slopes **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W018a forested wetland adjacent to stream. Located between gravel road and steep enbankment. FPH_Photos#DSCN5413. 0.27 acres. TRAM Score = 41 (Low)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W018a

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Salix nigra	20	☑	25.0%	OBL
2. Liriodendron tulipifera	20	☑	25.0%	FACU
3. Acer rubrum	20	☑	25.0%	FAC
4. Platanus occidentalis	15	☐	18.8%	FACW
5. Juniperus virginiana	5	☐	6.3%	FACU
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	80	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1. Lindera benzoin	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	10	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	10	☑	26.3%	FACW
2. Juncus effusus	10	☑	26.3%	FACW
3. Carex frankii	8	☑	21.1%	OBL
4. Microstegium vimineum	10	☑	26.3%	FAC
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	38	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	8	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	87.5%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	28	x 1 =	28
FACW species	35	x 2 =	70
FAC species	40	x 3 =	120
FACU species	25	x 4 =	100
UPL species	0	x 5 =	0
Column Totals:	128 (A)		318 (B)

Prevalence Index = B/A = 2.484

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W018a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 28-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W018b**

Investigator(s): Britta Lees/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388576 **Long.:** -87.685295 **Datum:** NAD83

Soil Map Unit Name: Humphreys Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:
Part of Scotts Creek floodplain; 0.20 acre; TRAM Low (41); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W018b

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 2'X5')				
1. Woodwardia areolata	15	☑	15.8%	FACW
2. Verbesina alternifolia	20	☑	21.1%	FAC
3. Impatiens capensis	15	☑	15.8%	FACW
4. Collinsonia canadensis	15	☑	15.8%	FAC
5. Boehmeria cylindrica	10	☐	10.5%	FACW
6. Juglans nigra	10	☐	10.5%	FACU
7. Silphium perfoliatum	10	☐	10.5%	FAC
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	95	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	40	x 2 =	80	
FAC species	45	x 3 =	135	
FACU species	10	x 4 =	40	
UPL species	0	x 5 =	0	
Column Totals:	95	(A)	255	(B)

Prevalence Index = B/A = 2.684

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W018b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-4	10YR	4/2	100						Silt Loam	
4-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 28-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W019a,c**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Gulch or Gully **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388204 **Long.:** 36.388204 **Datum:** NAD83

Soil Map Unit Name: Melvin silt loam, frequently flooded **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W019a,c emergent wetland surrounding stream, in ROW between road and steep enbankment and continues into forested wetland. W019a = 0.15 acres, W019c = <0.01 acres. TRAM Score = 46 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W019a,c

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0		= Total Cover	

Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Salix nigra	10	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10		= Total Cover	

Shrub Stratum (Plot size:)				
1. Lindera benzoin	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	10		= Total Cover	

Herb Stratum (Plot size:)				
1. Impatiens capensis	30	☑	33.3%	FACW
2. Juncus effusus	20	☑	22.2%	FACW
3. Carex frankii	10	☐	11.1%	OBL
4. Microstegium vimineum	20	☑	22.2%	FAC
5. Scirpus atrovirens	5	☐	5.6%	OBL
6. Sagittaria latifolia	5	☐	5.6%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	90		= Total Cover	

Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	30	x 1 =	30
FACW species	50	x 2 =	100
FAC species	30	x 3 =	90
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	110 (A)		220 (B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W019a,c

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	95	10YR 5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 28-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W019b**

Investigator(s): Fallon Parker Hutcheon/Britta Lees **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Gulch or Gully **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387614 **Long.:** -87.679982 **Datum:** NAD83

Soil Map Unit Name: Melvin silt loam, frequently flooded **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

W019b forested wetland surrounding stream between gravel road to north and steep embankment to the south.FPH_Photos#DSCN5419. W019b =3.55 acres. TRAM Score = 46 (Moderate)

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W019b

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Salix nigra	20	☑	25.0%	OBL
2. Liriodendron tulipifera	20	☑	25.0%	FACU
3. Acer rubrum	20	☑	25.0%	FAC
4. Platanus occidentalis	15	☐	18.8%	FACW
5. Juniperus virginiana	5	☐	6.3%	FACU
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	80	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1. Lindera benzoin	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	10	= Total Cover		
Herb Stratum (Plot size:)				
1. Impatiens capensis	10	☑	26.3%	FACW
2. Juncus effusus	10	☑	26.3%	FACW
3. Carex frankii	8	☑	21.1%	OBL
4. Microstegium vimineum	10	☑	26.3%	FAC
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	38	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	8	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	87.5%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	28	x 1 =	28
FACW species	35	x 2 =	70
FAC species	40	x 3 =	120
FACU species	25	x 4 =	100
UPL species	0	x 5 =	0
Column Totals:	128 (A)		318 (B)

Prevalence Index = B/A = 2.484

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W019b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	95	10YR	5/6	5	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 29-Jul-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W020**

Investigator(s): Britta Lees/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Depression **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.385577 **Long.:** -87.674401 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:
Depression in wide valley draining to Scotts Creek/Wells Creek confluence; mowed; 0.11 acre; TRAM Low (26); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W020

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10' radius')				
1. Panicum anceps	30	☑	28.6%	FAC
2. Festuca arundinacea	20	☑	19.0%	FACU
3. Coleataenia rigidula	15	☑	14.3%	FACW
4. Carex tribuloides	10	☐	9.5%	FACW
5. Carex vulpinoidea	10	☐	9.5%	OBL
6. Rubus argutus	10	☐	9.5%	FACU
7. Juncus effusus	10	☐	9.5%	FACW
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	105	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	66.7%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	10	x 1 =	10
FACW species	35	x 2 =	70
FAC species	30	x 3 =	90
FACU species	30	x 4 =	120
UPL species	0	x 5 =	0
Column Totals:	105	(A)	290 (B)

Prevalence Index = B/A = 2.762

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W020

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/2	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 12-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W021-EM**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Wide Valley **Local relief (concave, convex, none):** concave **Slope:** 3.0% / 1.7 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.393540 **Long.:** -87.667990 **Datum:** NAD83

Soil Map Unit Name: Lobelville Silt Loam, occasionally flooded **NWI classification:** PEM/PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Wide valley flat containing emergent wetland in ROW (W021-EM) and forested wetland outside of ROW (W021-FO); draining to Wells Creek confluence; 0.68 acre total; TRAM Moderate (48); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 2	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W021-EM

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10' radius')				
1. Carex lurida	40	☑	34.8%	OBL
2. Impatiens capensis	5	☐	4.3%	FACW
3. Carex tribuloides	20	☑	17.4%	FACW
4. Solidago gigantea	10	☐	8.7%	FACW
5. Scirpus cyperinus	10	☐	8.7%	FACW
6. Microstegium vimineum	10	☐	8.7%	FAC
7. Ludwigia alternifolia	10	☐	8.7%	FACW
8. Carex vulpinoidea	10	☐	8.7%	OBL
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	115	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50	
FACW species	55	x 2 =	110	
FAC species	10	x 3 =	30	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	115	(A)	190	(B)

Prevalence Index = B/A = 1.652

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W021-EM

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/2	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 12-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W021-FO**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Wide Valley **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.393318 **Long.:** -87.667560 **Datum:** NAD83

Soil Map Unit Name: Lobelville Silt Loam, occasionally flooded **NWI classification:** PEM/PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Wide valley flat containing emergent wetland in ROW (W021-EM) and forested wetland outside of ROW (W021-FO); draining to Wells Creek confluence; 0.68 acre total; TRAM Moderate (48); Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W021-FO

Tree Stratum (Plot size: 25'radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	20	☑	19.0%	FACW
2. Acer saccharinum	50	☑	47.6%	FACW
3. Gleditsia triacanthos	15	☐	14.3%	FAC
4. Ulmus americana	10	☐	9.5%	FACW
5. Liquidambar styraciflua	10	☐	9.5%	FAC
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	105	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 25'radius)				
1. Carpinus caroliniana	10	☑	33.3%	FAC
2. Ligustrum sinense	10	☑	33.3%	FACU
3. Ilex decidua	10	☑	33.3%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	30	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 25' radius')				
1. Chasmanthium latifolium	60	☑	57.1%	FACU
2. Lysimachia nummularia	5	☐	4.8%	FACW
3. Carex tribuloides	10	☐	9.5%	FACW
4. Carex intumescens	10	☐	9.5%	FACW
5. Microstegium vimineum	10	☐	9.5%	FAC
6. Boehmeria cylindrica	10	☐	9.5%	FACW
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	105	= Total Cover		

Woody Vine Stratum (Plot size: 25' radius')				
1. Toxicodendron pubescens	5	☑	50.0%	FACU
2. Smilax rotundifolia	5	☑	50.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	10	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 62.5% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	125	x 2 =	250
FAC species	50	x 3 =	150
FACU species	75	x 4 =	300
UPL species	0	x 5 =	0
Column Totals:	250 (A)		700 (B)

Prevalence Index = B/A = 2.800

Hydrophytic Vegetation Indicators:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☑ Dominance Test is > 50%
- ☑ Prevalence Index is ≤3.0 [1]
- ☐ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W021-FO

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/2	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 12-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W022**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Wide Valley **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.397998 **Long.:** -87.667909 **Datum:** NAD83

Soil Map Unit Name: Bodine Gravely Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:
Wide valley flat at confluence with Wells Creek; 0.19 acre; TRAM Low (44); Photos BPL_4076-7, FPH_5583-5.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W022

Tree Stratum (Plot size: 10X30')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	15	☐	15.0%	FACW
2. Fraxinus pennsylvanica	50	☑	50.0%	FACW
3. Celtis laevigata	25	☑	25.0%	FACW
4. Acer negundo	10	☐	10.0%	FAC
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	100	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 25'radius)				
1. Carpinus caroliniana	25	☑	62.5%	FAC
2. Cephalanthus occidentalis	15	☑	37.5%	OBL
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	40	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	90	x 2 =	180
FAC species	35	x 3 =	105
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	140 (A)		300 (B)

Prevalence Index = B/A = 2.143

Hydrophytic Vegetation Indicators:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☑ Dominance Test is > 50%
- ☑ Prevalence Index is ≤3.0 [1]
- ☐ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W022

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/3	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 12-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W023**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.400149 **Long.:** -87.668823 **Datum:** NAD83

Soil Map Unit Name: Wolftever Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Foresed wetland flat along Wells Creek embayment near confluence with Cumberland River; 1.83 acre; TRAM Moderate (53); no photos.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W023

Tree Stratum (Plot size: 10X30')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	15	☐	18.8%	FACW
2. Acer saccharinum	20	☑	25.0%	FACW
3. Acer rubrum	25	☑	31.3%	FAC
4. Celtis laevigata	10	☐	12.5%	FACW
5. Ulmus americana	10	☐	12.5%	FACW
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	80	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 25'radius)				
1. Cornus racemosa	25	☑	100.0%	FAC
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	25	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	55	x 2 =	110
FAC species	50	x 3 =	150
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	105 (A)		260 (B)

Prevalence Index = B/A = 2.476

Hydrophytic Vegetation Indicators:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☑ Dominance Test is > 50%
- ☑ Prevalence Index is ≤3.0 [1]
- ☐ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W023

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/2	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 12-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W024**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.397076 **Long.:** -87.663219 **Datum:** NAD83

Soil Map Unit Name: Wolftever Silt Loam **NWI classification:** PSS/FO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Intermixed forest and scrub-shrub (ss more prevelant at shoreline, under shade of backlying trees) in floodplain of embayment of Wells Creek near confluence with Cumberland River, sandwiched between old roadbed and CUF site to east; 0.79 acre; TRAM Moderate (53); no photos.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 1	
Water Table Present?	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W024

Tree Stratum (Plot size: 15'radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Salix nigra	15	☐	18.8%	OBL
2. Acer saccharinum	20	☑	25.0%	FACW
3. Acer rubrum	25	☑	31.3%	FAC
4. Celtis laevigata	10	☐	12.5%	FACW
5. Ulmus americana	10	☐	12.5%	FACW
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	80	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 15'radius)				
1. Cornus racemosa	25	☑	62.5%	FAC
2. Cephalanthus occidentalis	15	☑	37.5%	OBL
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	40	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	30	x 1 =	30	
FACW species	40	x 2 =	80	
FAC species	50	x 3 =	150	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	120	(A)	260	(B)

Prevalence Index = B/A = 2.167

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W024

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/2	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W025**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.398481 **Long.:** -87.665275 **Datum:** NAD83

Soil Map Unit Name: Wolftever Silt Loam **NWI classification:** PSS/FO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	
Hydric Soil Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Intermixed forest and scrub-shrub (ss more prevelant at shoreline, under shade of backlying trees) along shoreline fringe of old road along embayment of Wells Creek near confluence with Cumberland River; 0.73 acre; TRAM Moderate (53); no photos.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	1
Water Table Present?	Yes ◉ No ○	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W025

Tree Stratum (Plot size: 10'X40')	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Salix nigra	15	☐	18.8%	OBL
2. Acer saccharinum	20	☑	25.0%	FACW
3. Acer rubrum	25	☑	31.3%	FAC
4. Celtis laevigata	10	☐	12.5%	FACW
5. Ulmus americana	10	☐	12.5%	FACW
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	80	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 10'X40')				
1. Cornus racemosa	25	☑	62.5%	FAC
2. Cephalanthus occidentalis	15	☑	37.5%	OBL
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	40	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	30	x 1 =	30	
FACW species	40	x 2 =	80	
FAC species	50	x 3 =	150	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	120	(A)	260	(B)

Prevalence Index = B/A = 2.167

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W025

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/2	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 11-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W026**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.398956 **Long.:** -87.663946 **Datum:** NAD83

Soil Map Unit Name: Egam silty clay loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Forested wetland flat in floodplain of embayment of Wells Creek near confluence with Cumberland River; 6.86 acre; TRAM Moderate (54); photos BPL_4065-8.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W026

Tree Stratum (Plot size: 25' radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	20	☑	21.1%	FACW
2. Acer saccharinum	25	☑	26.3%	FACW
3. Acer rubrum	20	☑	21.1%	FAC
4. Celtis laevigata	20	☑	21.1%	FACW
5. Ulmus americana	10	☐	10.5%	FACW
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	95	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: 25' radius)				
1. Cornus racemosa	25	☑	100.0%	FAC
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	25	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 10'radius)				
1. Chasmanthium latifolium	30	☑	60.0%	FACU
2. Elymus virginicus	20	☑	40.0%	FACW
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	50	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 85.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	95	x 2 =	190	
FAC species	45	x 3 =	135	
FACU species	30	x 4 =	120	
UPL species	0	x 5 =	0	
Column Totals:	170	(A)	445	(B)

Prevalence Index = B/A = 2.618

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W026

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/2	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 12-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W027**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.401391 **Long.:** -87.667798 **Datum:** NAD83

Soil Map Unit Name: Egam silty clay loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Foresed wetland flat along north side of Wells Creek embayment near confluence with Cumberland River; includes portion of old woods road; 1.93 acre; TRAM Moderate (53); no photos.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W027

Tree Stratum (Plot size: 25' radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	20	☑	23.5%	FACW
2. Acer saccharinum	25	☑	29.4%	FACW
3. Liquidambar styraciflua	20	☑	23.5%	FAC
4. Acer negundo	20	☑	23.5%	FAC
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	85	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	0	x 1 =	0
FACW species	45	x 2 =	90
FAC species	40	x 3 =	120
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	85	(A)	210 (B)

Prevalence Index = B/A = 2.471

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W027

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-4	10YR	4/3	100						Silt Loam	
4-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 12-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W028**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.398506 **Long.:** -87.662232 **Datum:** NAD83

Soil Map Unit Name: Staser Fine Sandy Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Foresed wetland flat in floodplain of Cumberland River; 1.84 acre; TRAM Moderate (53); Photos KM_0281-4.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W028

Tree Stratum (Plot size: 20' radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	20	☑	21.1%	FACW
2. Acer saccharinum	25	☑	26.3%	FACW
3. Ulmus americana	20	☑	21.1%	FACW
4. Acer negundo	20	☑	21.1%	FAC
5. Salix nigra	10	☐	10.5%	OBL
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	95	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 20' radius)				
1. Elymus virginicus	40	☑	80.0%	FACW
2. Persicaria virginiana	10	☑	20.0%	FAC
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	50	= Total Cover		

Woody Vine Stratum (Plot size: 20' radius)				
1. Vitis riparia	5	☑	100.0%	FACW
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	10	x 1 =	10
FACW species	110	x 2 =	220
FAC species	30	x 3 =	90
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	150	(A)	320 (B)

Prevalence Index = B/A = 2.133

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W028

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR 4/2	100					Sandy Loam	
3-12+	10YR 5/2	80	10YR 4/6	20	D	M	Sandy Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 12-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W029**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.401113 **Long.:** -87.664070 **Datum:** NAD83

Soil Map Unit Name: Mountview Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Old man made depression/pond; recieves hydrology from rain and runoff from immediate landscape, isolated; TRAM Low (26); no photos.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 1	
Water Table Present?	Yes ○ No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W029

Tree Stratum (Plot size: 10'radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis laevigata	75	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	75	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	0	x 1 =	0
FACW species	75	x 2 =	150
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	75 (A)		150 (B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W029

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-8	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	
8-12+	10YR	5/4	100						Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 12-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W030**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.404280 **Long.:** -87.665230 **Datum:** NAD83

Soil Map Unit Name: Sengtown Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Foresed wetland flat in floodplain of Cumberland River; 4.43 acre; TRAM Moderate (54); no photos.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W030

Tree Stratum (Plot size: 25' radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Platanus occidentalis	20	☑	21.1%	FACW
2. Acer saccharinum	25	☑	26.3%	FACW
3. Ulmus americana	20	☑	21.1%	FACW
4. Acer negundo	20	☑	21.1%	FAC
5. Salix nigra	10	☐	10.5%	OBL
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	95	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	65	x 2 =	130
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	95 (A)		200 (B)

Prevalence Index = B/A = 2.105

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W030

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc[2]	Texture	Remarks
0-3	10YR	4/2	100						Silt Loam	
3-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W031**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.391656 **Long.:** -87.666257 **Datum:** NAD83

Soil Map Unit Name: NA **NWI classification:** PEM1Ex

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Meets wetland definition, although man made and located on active fossil plant site where plant operations and ashpond closure is ongoing; provides wetland values (TRAM low, 15), although jurisdictional status TBD; 0.06 acre; Photos BPL_5484-5.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 6	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W031

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5X10')				
1. Phragmites australis	100	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	100	x 2 =	200	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	100	(A)	200	(B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W031

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W032**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.391212 **Long.:** -87.661063 **Datum:** NAD83

Soil Map Unit Name: NA **NWI classification:** PEM1Ex

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Meets wetland definition, although man made and located on active fossil plant site where plant operations and ashpond closure is ongoing; provides wetland values (TRAM low, 15), although jurisdictional status TBD; 0.75 acre; Photos BPL_5482-3.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 6	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W032

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5X10')				
1. Phragmites australis	100	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W032

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W033**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.392860 **Long.:** -87.659445 **Datum:** NAD83

Soil Map Unit Name: NA **NWI classification:** PEM1Ex

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Meets wetland definition, although man made and located on active fossil plant site where plant operations and ash pond closure is ongoing; provides wetland values (TRAM low, 15), although jurisdictional status TBD; 0.27 acre; Photos FPH_5543.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	6
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W033

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5X10')				
1. Phragmites australis	100	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W033

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W034**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387453 **Long.:** -87.656162 **Datum:** NAD83

Soil Map Unit Name: NA **NWI classification:** PEM1Ex

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Meets wetland definition, although man made and located on active fossil plant site where plant operations and ash pond closure is ongoing; provides wetland values (TRAM low, 15), although jurisdictional status TBD; 0.31 acre; Photos FPH_5533-4.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): ____

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W034

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5X10')				
1. Phragmites australis	100	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W034

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W035**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Fringe **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388134 **Long.:** -87.655612 **Datum:** NAD83

Soil Map Unit Name: NA **NWI classification:** PEM1Ex

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Fringe of retention basin/settling pond; meets wetland definition although man made and located on active fossil plant site where plant operations and ash pond closure is ongoing; provides wetland values (TRAM low, 15), although jurisdictional status TBD; 0.94 acre; Photos BPL_5330-2,5.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 6	
Water Table Present?	Yes ○ No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W035

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5X10')				
1. Phragmites australis	100	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W035

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W036**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Fringe **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.386217 **Long.:** -87.651810 **Datum:** NAD83

Soil Map Unit Name: NA **NWI classification:** PEM1Ex

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Fringe of pond; meets wetland definition although man made and located on active fossil plant site where plant operations and ash pond closure is ongoing; provides wetland values (TRAM low, 15), although jurisdictional status TBD; 0.08 acre; Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 6	
Water Table Present?	Yes ○ No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W036

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5X10')				
1. Phragmites australis	20	☑	25.0%	FACW
2. Juncus effusus	60	☑	75.0%	FACW
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	80	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	80	x 2 =	160
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	80 (A)		160 (B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W036

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W037**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Depression **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387676 **Long.:** -87.652263 **Datum:** NAD83

Soil Map Unit Name: NA **NWI classification:** PEM/SS1Ex

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Meets wetland definition although man made and located on active fossil plant site where plant operations and ash pond closure is ongoing; provides wetland values (TRAM low, 15), although jurisdictional status TBD; 0.03 acre; Photos FPH_5537.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W037

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: 5X5')				
1. Salix nigra	40	☑	100.0%	OBL
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	40	= Total Cover		

Herb Stratum (Plot size: 5X5')				
1. Phragmites australis	60	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	60	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40	
FACW species	60	x 2 =	120	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	100	(A)	160	(B)

Prevalence Index = B/A = 1.600

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W037

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W038**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.390026 **Long.:** -87.651180 **Datum:** NAD83

Soil Map Unit Name: NA **NWI classification:** PEM/SS1Ex

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Meets wetland definition although man made and located on active fossil plant site where plant operations and ash pond closure is ongoing; provides wetland values (TRAM low, 15), although jurisdictional status TBD; 0.68 acre; Photos FPH_5538-40.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W038

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: 5X20')				
1. Salix nigra	10	☑	33.3%	OBL
2. Fraxinus pennsylvanica	10	☑	33.3%	FACW
3. Celtis laevigata	10	☑	33.3%	FACW
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	30	= Total Cover		

Herb Stratum (Plot size: 5X10')				
1. Phragmites australis	75	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	75	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	10	x 1 =	10
FACW species	95	x 2 =	190
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	105	(A)	200 (B)

Prevalence Index = B/A = 1.905

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W038

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W039**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 3.0% / 1.7 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.386369 **Long.:** -87.649440 **Datum:** NAD83

Soil Map Unit Name: NA **NWI classification:** PEM1Ex

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Meets wetland definition although man made and located on active fossil plant site where plant operations and ash pond closure is ongoing; provides wetland values (TRAM low, 15), although jurisdictional status TBD; 0.84 acre; Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): ____
Water Table Present?	Yes ○	No ◉	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W039

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 5X10')				
1. Phragmites australis	100	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W039

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 6/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W040**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 2.0% / 1.1 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388047 **Long.:** -87.648631 **Datum:** NAD83

Soil Map Unit Name: NA **NWI classification:** PEM1Ex

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Meets wetland definition although man made and located on active fossil plant site where plant operations and ash pond closure is ongoing; provides wetland values (TRAM low, 15), although jurisdictional status TBD; 0.38 acre; Photos BPL_iPad.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W040

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 20X10')				
1. Phragmites australis	100	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	100	= Total Cover		
Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	100	x 2 =	200	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	100	(A)	200	(B)

Prevalence Index = B/A = 2.000

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W040

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/1	100					Silt	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W041a**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.392139 **Long.:** -87.644112 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PEM1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Emergent wetland inudated and along shoreline; 8.10 acres; associated with forested wetland in wide valley flat feeding complex (W041c) and scrub-shrub wetland in shallows (W041b); TRAM Moderate (52); Photos BPL_4053-61.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 6	
Water Table Present?	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W041a

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size: 15' radius)				
1. Typha latifolia	20	☑	23.5%	OBL
2. Scirpus atrovirens	20	☑	23.5%	OBL
3. Sagittaria latifolia	15	☑	17.6%	OBL
4. Leersia oryzoides	15	☑	17.6%	OBL
5. Juncus effusus	15	☑	17.6%	FACW
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	85	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	70	x 1 =	70	
FACW species	15	x 2 =	30	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	85	(A)	100	(B)

Prevalence Index = B/A = 1.176

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W041a

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR 5/2	80	10YR 4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W041b**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.388437 **Long.:** -87.645246 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PSS1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Scrub-shrub wetland in shallows of ponded area; 4.60 acres; associated with forested wetland in wide valley flat feeding complex (W041c) and emergent habitat (W041a) along waters edge; TRAM Moderate (52); Photos BPL_4053-61.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 1	
Water Table Present?	Yes ◉ No ○	Depth (inches): 0	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W041b

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size: 15' radius)				
1. Hibiscus laevis	10	☐	11.8%	OBL
2. Hibiscus moscheutos	15	☐	17.6%	OBL
3. Cephalanthus occidentalis	50	☑	58.8%	OBL
4. Cornus racemosa	10	☐	11.8%	FAC
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	85	= Total Cover		

Herb Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size: _____)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	75	x 1 =	75	
FACW species	0	x 2 =	0	
FAC species	10	x 3 =	30	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	85	(A)	105	(B)

Prevalence Index = B/A = 1.235

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W041b

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Cumberland Fossil Plant Comprehensive Site Survey **City/County:** Cumberland City/Stewart **Sampling Date:** 10-Aug-21

Applicant/Owner: Tennessee Valley Authority **State:** TN **Sampling Point:** **W041c**

Investigator(s): Britta Lees/Fallon PH/Kenn McMahan **Section, Township, Range:** S ____ T ____ R ____

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 2.0% / 1.1 °

Subregion (LRR or MLRA): LRR N **Lat.:** 36.387392 **Long.:** -87.645267 **Datum:** NAD83

Soil Map Unit Name: Melvin Silt Loam **NWI classification:** PFO1E

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

Foresed wetland in wide valley flat feeding ponded area; 13.78 acre; associated with scrubshrub in shallows (W041b) and emergent habitat (W041a) along waters edge; TRAM Moderate (52); Photos BPL_4053-61.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 6	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: W041c

Tree Stratum (Plot size: 25' radius)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Fraxinus pennsylvanica	20	☑	18.2%	FACW
2. Acer saccharinum	25	☑	22.7%	FACW
3. Ulmus americana	20	☑	18.2%	FACW
4. Celtis laevigata	20	☑	18.2%	FACW
5. Platanus occidentalis	10	☐	9.1%	FACW
6. Liquidambar styraciflua	15	☐	13.6%	FAC
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	110	= Total Cover		

Sapling-Sapling/Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		

Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.		☐	0.0%	
8.		☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	95	x 2 =	190	
FAC species	15	x 3 =	45	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	110	(A)	235	(B)

Prevalence Index = B/A = 2.136

Hydrophytic Vegetation Indicators:

- ☑ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: W041c

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox Features %	Type [1]	Loc[2]	Texture	Remarks
0-12+	10YR	5/2	80	10YR	4/6	20	D	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Appendix B

Tennessee (Non-HGM) Rapid Assessment Methodology Forms

Cumberland Fossil Plant

Britta Lees

W001 a,b,c

8/10/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.		
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	1	
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 2.50

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	1	2b Avg.= 3.00

Cumberland Fossil Plant

W001 a,b,c

Metric 2 Total 5.50

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	3
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	3
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 3.00

Cumberland Fossil Plant

W001 a,b,c

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

X	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland	X	dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 7.00

Cumberland Fossil Plant

Metric 3 Total 23.00

W001 a,b,c

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 12

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.

	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	1
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	2.00
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W001 a,b,c

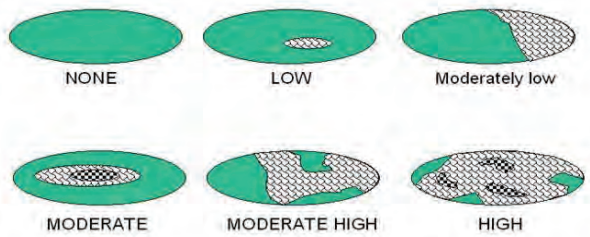

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	**Narrative description**
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 5

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	5.5
	Metric 3: Hydrology	23
	Metric 4: Habitat	12
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	5
	TOTAL SCORE	48

Cumberland Fossil Plant

W001 a,b,c

Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

W002

8/10/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.		
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 4.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	1	2b Avg.= 3.00

Cumberland Fossil Plant

W002

Metric 2 Total 7.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	3
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 3.00

Cumberland Fossil Plant

W002

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 7.00

Cumberland Fossil Plant

Metric 3 Total 21.00

W002

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	5.00
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 5.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 14

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points). **6a. Wetland Vegetation Communities** Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	Score
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	2
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W002

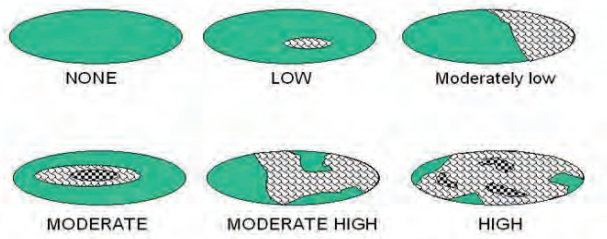

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 3

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	7
	Metric 3: Hydrology	21
	Metric 4: Habitat	14
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	3
	TOTAL SCORE	47

Cumberland Fossil Plant

W002
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

W003

8/10/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.		
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	1	
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 2.50

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 5.00

Cumberland Fossil Plant

W003

Metric 2 Total 7.50

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 3.00

Cumberland Fossil Plant

W003

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 7.00

Cumberland Fossil Plant

Metric 3 Total 21.00

W003

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 12

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.

	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W003

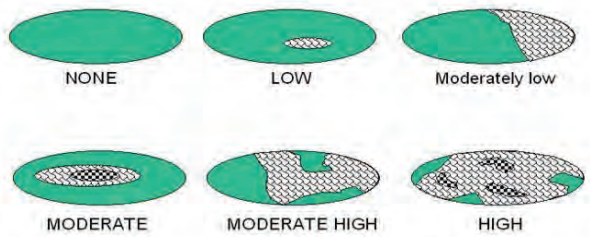

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 3

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	7.5
	Metric 3: Hydrology	21
	Metric 4: Habitat	12
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	3
	TOTAL SCORE	46

Cumberland Fossil Plant

W003
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

W004

8/10/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	1

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 1

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.		
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	1	
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 2.50

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 5.00

Cumberland Fossil Plant

W004

Metric 2 Total 7.50

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 3.00

Cumberland Fossil Plant

W004

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 7.00

Cumberland Fossil Plant

Metric 3 Total 17.00

W004

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 12

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points). **6a. Wetland Vegetation Communities** Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	Score
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB_3) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W004

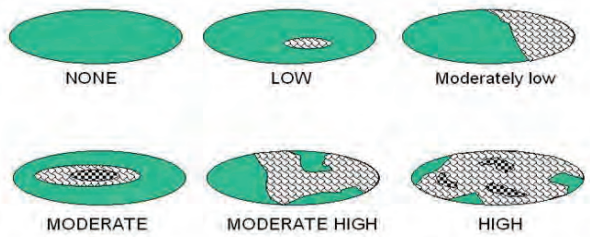

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 3

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	1
	Metric 2: Buffers and surrounding land use	7.5
	Metric 3: Hydrology	17
	Metric 4: Habitat	12
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	3
	TOTAL SCORE	41

Cumberland Fossil Plant

W004
Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

W005

8/07/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	3
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
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10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 3

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	1	2b Avg.= 3.00

Cumberland Fossil Plant

W005

Metric 2 Total 10.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 3.00

Cumberland Fossil Plant

W005

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 7.00

Cumberland Fossil Plant

Metric 3 Total 24.00

W005

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 12

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points). **6a. Wetland Vegetation Communities** Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	Score
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W005

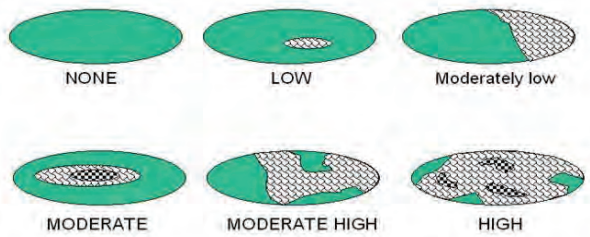

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 3

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	3
	Metric 2: Buffers and surrounding land use	10
	Metric 3: Hydrology	24
	Metric 4: Habitat	12
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	3
	TOTAL SCORE	52

Cumberland Fossil Plant

W005
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

W006

8/07/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 3.00

Cumberland Fossil Plant

W006

Metric 2 Total 10.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 3.00

Cumberland Fossil Plant

W006

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland	X	dredging activities in or near the wetland
	stormwater inputs (addition of water)	X	other (specify) old pond

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 7.00

Cumberland Fossil Plant

Metric 3 Total 12.00

W006

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation __x__dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 3.00

Metric 4 Total 9

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.

	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	3.00
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W006

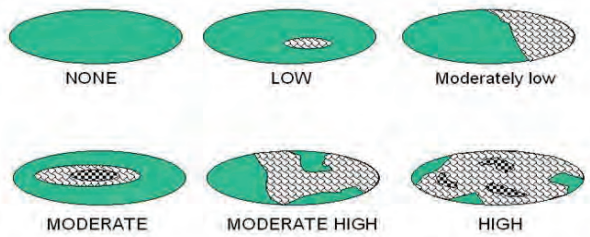

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 5

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	10
	Metric 3: Hydrology	12
	Metric 4: Habitat	9
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	5
	TOTAL SCORE	38

Cumberland Fossil Plant

W006
Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W007

8/11/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	3
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 3

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 3.00

Cumberland Fossil Plant

W007

Metric 2 Total 10.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	3
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	1

3d Avg.= 2.00

Cumberland Fossil Plant

W007

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 7.00

Cumberland Fossil Plant

Metric 3 Total 23.00

W007

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing __x__grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	2.00
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 2.50

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	4.00
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 4.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
X	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 3.00

Metric 4 Total 9.5

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	2
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	2.00
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W007

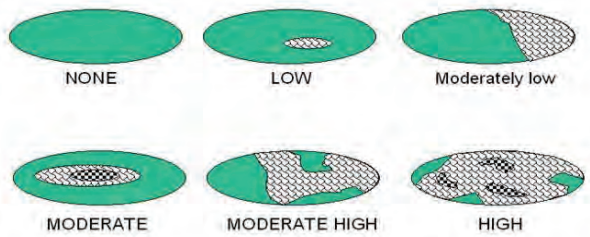

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 4

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	3
	Metric 2: Buffers and surrounding land use	10
	Metric 3: Hydrology	23
	Metric 4: Habitat	9.5
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	4
	TOTAL SCORE	50

Cumberland Fossil Plant

W007
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W008, W009, W010

8/11/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	4
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 4

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 3.00

Cumberland Fossil Plant

W008, W009, W010

Metric 2 Total 10.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	3
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	1

3d Avg.= 2.00

Cumberland Fossil Plant

W008, W009, W010

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 7.00

Cumberland Fossil Plant

Metric 3 Total 23.00

W008, W009, W010

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing __x__grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	2.00
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 2.50

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	4.00
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 4.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
X	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 3.00

Metric 4 Total 9.5

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.

	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	2
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	2.00
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

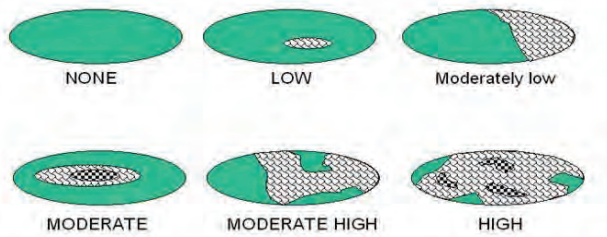

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 5

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	4
	Metric 2: Buffers and surrounding land use	10
	Metric 3: Hydrology	23
	Metric 4: Habitat	9.5
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	5
	TOTAL SCORE	52

Cumberland Fossil Plant

W008, W009, W010
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

W011

7/29/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	6
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
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3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 6

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.	0	2a Avg.= 3.50

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	1	2b Avg.= 3.00

Cumberland Fossil Plant

W011

Metric 2 Total 6.50

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	3
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	4
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	1

3d Avg.= 2.50

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3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

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Metric 3 Total 28.00

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Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing __x__grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	6
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 6.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
X	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
X	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	0
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 15

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	2
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	2
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	2
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	1
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	3.00
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

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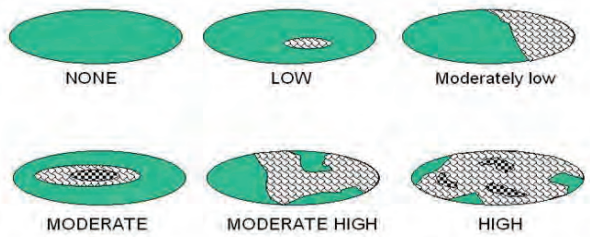

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 9

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	6
	Metric 2: Buffers and surrounding land use	6.5
	Metric 3: Hydrology	28
	Metric 4: Habitat	15
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	9
	TOTAL SCORE	65

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Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.			
7pts	WIDE. >50m (164ft) or more around perimeter.		
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 4.00
2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.			
7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	7	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 6.00

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Metric 2 Total 10.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity. **A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	3
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "...the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	3
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 3.00

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3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg=
7.00

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Metric 3 Total 18.00

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Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	6.00
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 6.00

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W012

PID#38806

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. =
6.00

Metric 4 Total 15

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	3
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB_3) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	3.0
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

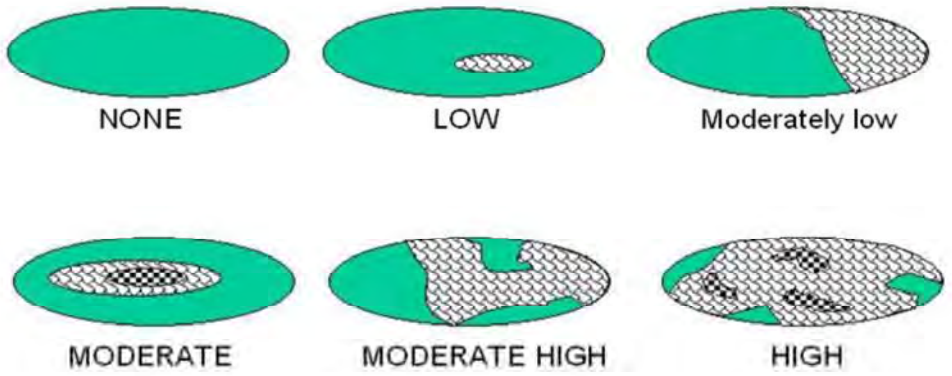

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.	Score
-5pts Extensive >75% areal cover of invasive species	
-3pts Moderate 25-75% areal cover of invasive species	
-1pts Sparse 5-25% areal cover of invasive species	
0pt Nearly absent. <5% areal cover of invasive species	0
1pt Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.	Score
Vegetated hummocks and tussocks	
Coarse woody debris >15cm (6in) in diameter	
Standing dead trees >25cm (10in) diameter at breast height	
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction	

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	**Narrative description**
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 6

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	10
	Metric 3: Hydrology	18
	Metric 4: Habitat	15
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	6
	TOTAL SCORE	51

Cumberland Fossil Plant

PID#38806

W012

Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

W013

7/29/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	1

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 1

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.		
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.	0	2a Avg.= 2.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	1	2b Avg.= 3.00

Cumberland Fossil Plant

W013

Metric 2 Total 5.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W013

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland	X	filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland	X	dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	3
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 5.00

Cumberland Fossil Plant

Metric 3 Total 12.00

W013

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing __x__grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	2.00
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 2.50

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	2.00
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 2.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting	X	Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 4.50

Metric 4 Total 9

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W013

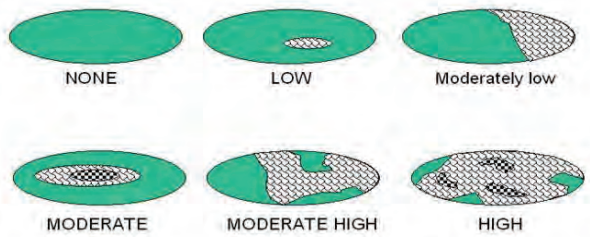

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 0

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	1
	Metric 2: Buffers and surrounding land use	5
	Metric 3: Hydrology	12
	Metric 4: Habitat	9
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	0
	TOTAL SCORE	27

Cumberland Fossil Plant

W013
Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

W014

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

7/30/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 5.50

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	1	2b Avg.= 3.00

Cumberland Fossil Plant

W014

Metric 2 Total 8.50

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W014

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	3
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 5.00

Cumberland Fossil Plant

Metric 3 Total 13.00

W014

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing __x__grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	2.00
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 2.50

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 4.50

Metric 4 Total 10

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	2.00
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	2.00
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	2.00
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W014

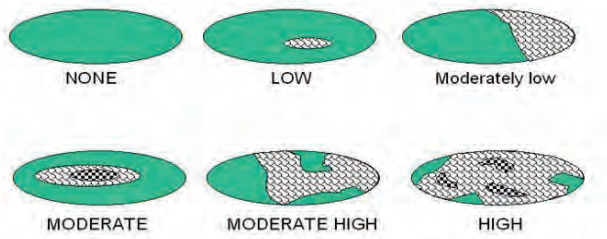

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 1

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	8.5
	Metric 3: Hydrology	13
	Metric 4: Habitat	10
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	1
	TOTAL SCORE	39

Cumberland Fossil Plant

W014
Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W015

7/27/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	1

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
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3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 1

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	
0pts	VERY NARROW. <10m (<32ft) around perimeter.	

2a Avg.= 5.50

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.	
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	

2b Avg.= 5.00

Cumberland Fossil Plant

W015

Metric 2 Total 10.50

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	3
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W015

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	3
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 5.00

Cumberland Fossil Plant

Metric 3 Total 16.00

W015

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	2.00
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 2.50

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	4.00
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 4.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 4.50

Metric 4 Total 11

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	3.00
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W015

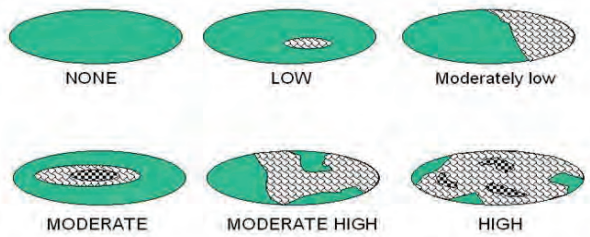

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	**Narrative description**
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 2

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	1
	Metric 2: Buffers and surrounding land use	10.5
	Metric 3: Hydrology	16
	Metric 4: Habitat	11
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	2
	TOTAL SCORE	41

Cumberland Fossil Plant

W015
Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

W016

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

7/27/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	1

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 1

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	
0pts	VERY NARROW. <10m (<32ft) around perimeter.	

2a Avg.= 5.50

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.	
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	

2b Avg.= 5.00

Cumberland Fossil Plant

W016

Metric 2 Total 10.50

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W016

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	3
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 5.00

Cumberland Fossil Plant

Metric 3 Total 12.00

W016

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	2.00
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 2.50

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	2.00
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 2.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

X	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 3.00

Metric 4 Total 7.5

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	0

Cumberland Fossil Plant W016

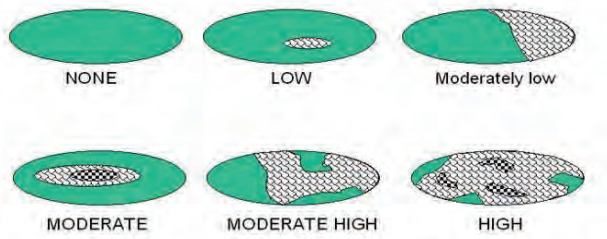

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total -1

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	1
	Metric 2: Buffers and surrounding land use	10.5
	Metric 3: Hydrology	12
	Metric 4: Habitat	7.5
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	-1
	TOTAL SCORE	30

Cumberland Fossil Plant

W016
Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W017a,b,c,d,e

7/28/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	
0pts	VERY NARROW. <10m (<32ft) around perimeter.	

2a Avg.= 5.50

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.	
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	

2b Avg.= 5.00

Cumberland Fossil Plant

W017a,b,c,d,e

Metric 2 Total 10.50

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W017a,b,c,d,e

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland	X	filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland	X	dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	1

3e Avg= 4.00

Cumberland Fossil Plant

Metric 3 Total 11.00

W017a,b,c,d,e

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): _x__filling and grading ____plowing ____grazing (hooves) _x__vehicle use (off-road vehicles, construction vehicles) ____sedimentation _x__dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	1.00

4a Avg.= 2.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	2.00
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 2.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

X	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
X	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 4.50

Metric 4 Total 8.5

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1.00
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	2.00
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W017a,b,c,d,e

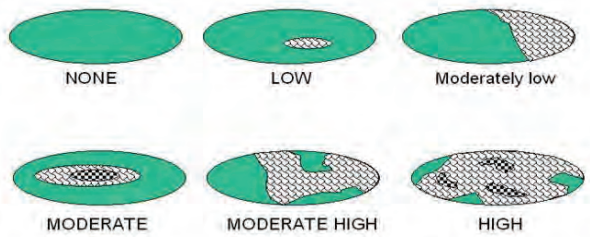

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 4

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	10.5
	Metric 3: Hydrology	11
	Metric 4: Habitat	8.5
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	4
	TOTAL SCORE	36

Cumberland Fossil Plant

W017a,b,c,d,e
Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W018a,b

7/28/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	1

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 1

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	
0pts	VERY NARROW. <10m (<32ft) around perimeter.	

2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.	
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	

2b Avg.= 5.00

Cumberland Fossil Plant

W018a,b

Metric 2 Total 12.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W018a,b

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

Cumberland Fossil Plant

Metric 3 Total 18.50

W018a,b

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) __x__vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

X	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
X	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 3.00

Metric 4 Total 9

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1.00
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	0

Cumberland Fossil Plant W018a,b

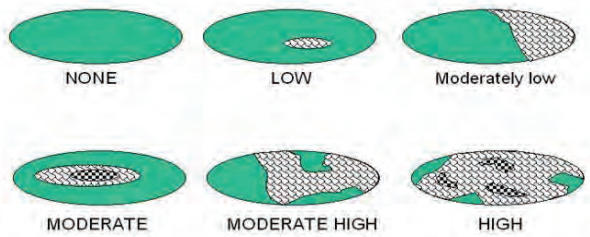

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 0

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	1
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	18.5
	Metric 4: Habitat	9
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	0
	TOTAL SCORE	41

Cumberland Fossil Plant

W018a,b

Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	3
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
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0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 3

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.			
7pts	WIDE. >50m (164ft) or more around perimeter.		
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	4	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 4.00
2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.			
7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	7	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.		
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	1	2b Avg.= 4.00

Cumberland Fossil Plant

PID#38806

W019a,b,c

Metric 2 Total 8.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "...the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	1

3d Avg.= 3.00

Cumberland Fossil Plant

PID#38806

W019a,b,c

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg=
7.00

Cumberland Fossil Plant

Metric 3 Total 17.00

PID#38806

W019a,b,c

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	4.0
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 4.00

Cumberland Fossil Plant

W019a,b,c

PID#38806

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 13

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.

	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	2.0
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB_3) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	3.0
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

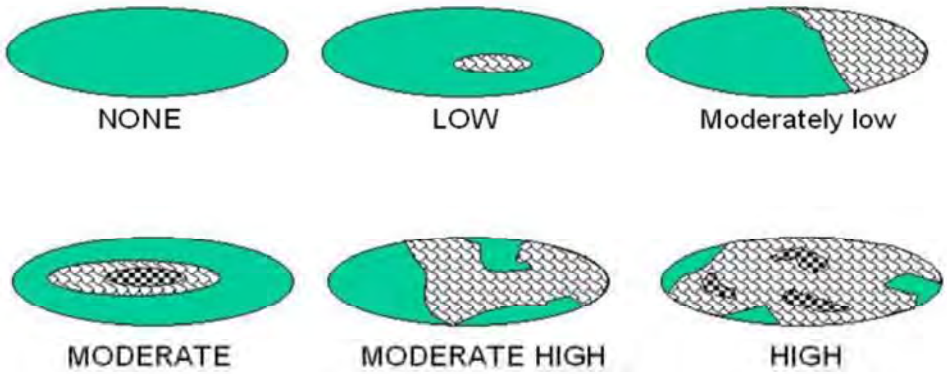

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.	Score
-5pts Extensive >75% areal cover of invasive species	
-3pts Moderate 25-75% areal cover of invasive species	
-1pts Sparse 5-25% areal cover of invasive species	
0pt Nearly absent. <5% areal cover of invasive species	0
1pt Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.	Score
Vegetated hummocks and tussocks	
Coarse woody debris >15cm (6in) in diameter	
Standing dead trees >25cm (10in) diameter at breast height	
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction	

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	**Narrative description**
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 5

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	3
	Metric 2: Buffers and surrounding land use	8
	Metric 3: Hydrology	17
	Metric 4: Habitat	13
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	5
	TOTAL SCORE	46

Cumberland Fossil Plant

PID#38806

W019a,b,c

Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W020

7/29/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	1

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 1

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 5.00

Cumberland Fossil Plant

W020

Metric 2 Total 12.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	1

3d Avg.= 0.00

Cumberland Fossil Plant

W020

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
X	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	3
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 3.00

Cumberland Fossil Plant

Metric 3 Total 5.00

W020

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation __x__dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	2.00
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 2.50

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 3.00

Metric 4 Total 8.5

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	0

Cumberland Fossil Plant W020

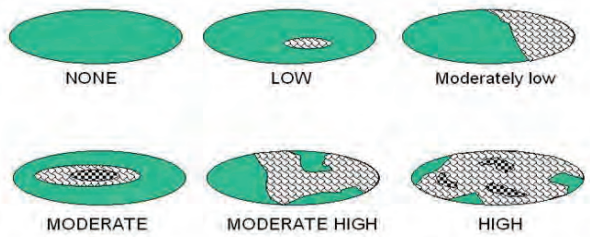

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total -1

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	1
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	5
	Metric 4: Habitat	8.5
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	-1
	TOTAL SCORE	26

Cumberland Fossil Plant

W020
Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W021

8/12/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	
0pts	VERY NARROW. <10m (<32ft) around perimeter.	

2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.	
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	

2b Avg.= 5.00

Cumberland Fossil Plant

W021

Metric 2 Total 12.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W021

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

Cumberland Fossil Plant

Metric 3 Total 18.50

W021

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) __x__vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

X	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
X	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 4.50

Metric 4 Total 10.5

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	2.00
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	2.00
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W021

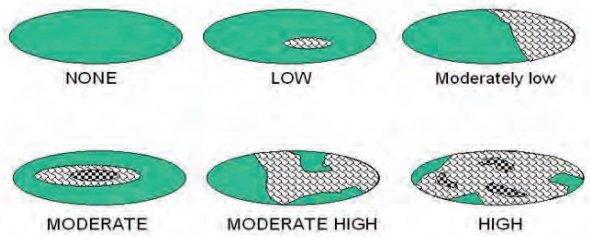

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	**Narrative description**
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 5

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	18.5
	Metric 4: Habitat	10.5
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	5
	TOTAL SCORE	48

Cumberland Fossil Plant

W021
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

W022

8/12/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	1

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 1

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 5.00

Cumberland Fossil Plant

W022

Metric 2 Total 12.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W022

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

Cumberland Fossil Plant

Metric 3 Total 18.50

W022

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	4
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 4.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 13

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	0

Cumberland Fossil Plant W022

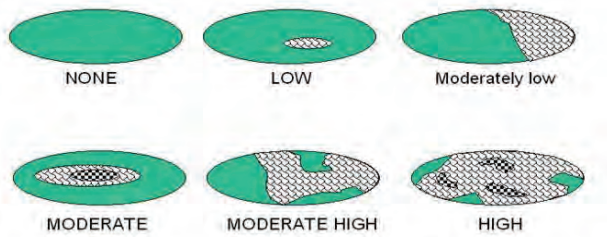

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total -1

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	1
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	18.5
	Metric 4: Habitat	13
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	-1
	TOTAL SCORE	44

Cumberland Fossil Plant

W022
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

W023

7/29/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
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3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	
0pts	VERY NARROW. <10m (<32ft) around perimeter.	

2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.	
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	

2b Avg.= 5.00

Cumberland Fossil Plant

W023

Metric 2 Total 12.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W023

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
X	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

Cumberland Fossil Plant

Metric 3 Total 25.50

W023

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	4.00
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.=

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 9

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	2.00
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W023

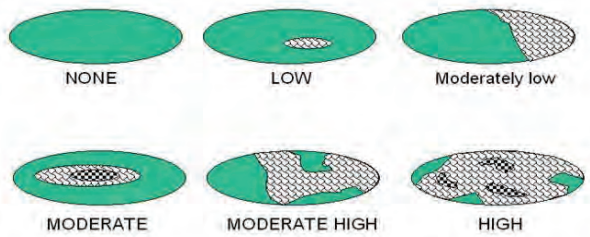

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 4

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	25.5
	Metric 4: Habitat	9
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	4
	TOTAL SCORE	53

Cumberland Fossil Plant

W023
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W024

8/12/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	
0pts	VERY NARROW. <10m (<32ft) around perimeter.	

2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.	
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	

2b Avg.= 5.00

Cumberland Fossil Plant

W024

Metric 2 Total 12.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W024

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
X	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

Cumberland Fossil Plant

Metric 3 Total 25.50

W024

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

	YES	NO	NOT SURE
Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	Assign a score of 4 since there are no or no apparent modifications.	Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

	YES	NO	NOT SURE
Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	Assign a score of 9 since there are no or no apparent modifications.	Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 4.50

Metric 4 Total 10.5

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	2.00
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W024

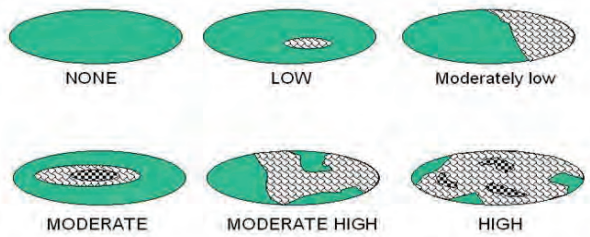

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 3

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	25.5
	Metric 4: Habitat	10.5
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	3
	TOTAL SCORE	53

Cumberland Fossil Plant

W024
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W025

8/12/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 5.00

Cumberland Fossil Plant

W025

Metric 2 Total 12.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W025

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
X	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

Cumberland Fossil Plant

Metric 3 Total 25.50

W025

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 4.50

Metric 4 Total 10.5

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points). **6a. Wetland Vegetation Communities** Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	Score
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	2.00
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W025

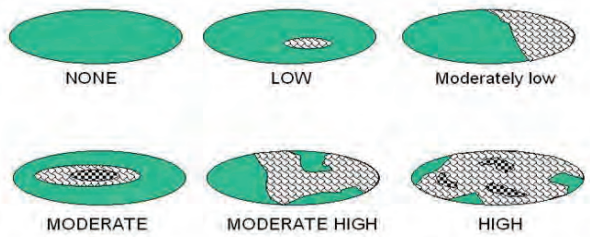

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 3

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	25.5
	Metric 4: Habitat	10.5
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	3
	TOTAL SCORE	53

Cumberland Fossil Plant

W025
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W026

8/12/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	3
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 3

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	
0pts	VERY NARROW. <10m (<32ft) around perimeter.	

2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.	
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	

2b Avg.= 5.00

Cumberland Fossil Plant

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Metric 2 Total 12.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

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3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
X	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

Cumberland Fossil Plant

Metric 3 Total 25.50

W026

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	4.00
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.=

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 9

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points). **6a. Wetland Vegetation Communities** Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	Score
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	2.00
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W026

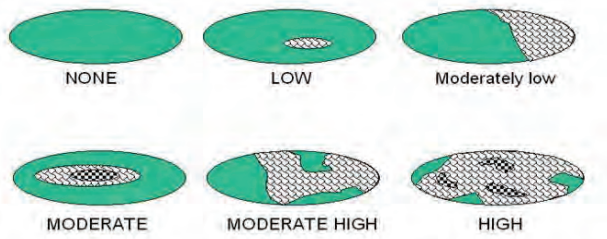

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 4

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	3
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	25.5
	Metric 4: Habitat	9
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	4
	TOTAL SCORE	54

Cumberland Fossil Plant

W026
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

W027

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

7/29/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 5.00

Cumberland Fossil Plant

W027

Metric 2 Total 12.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W027

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
X	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

Cumberland Fossil Plant

Metric 3 Total 25.50

W027

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	4.00
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.=

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 9

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	2.00
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

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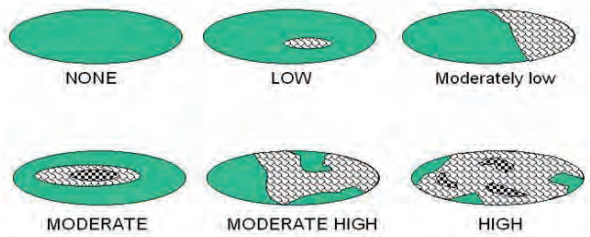

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 4

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	25.5
	Metric 4: Habitat	9
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	4
	TOTAL SCORE	53

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Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

W028

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

7/29/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7	
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.		2b Avg.= 5.00

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Metric 2 Total 12.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

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3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
X	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

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Metric 3 Total 25.50

W028

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	4.00
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.=

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 9

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	2.00
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W028

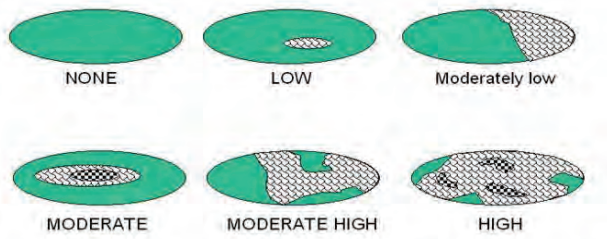

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 4

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	25.5
	Metric 4: Habitat	9
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	4
	TOTAL SCORE	53

Cumberland Fossil Plant

W028
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W029

7/29/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	1

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 1

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	
0pts	VERY NARROW. <10m (<32ft) around perimeter.	

2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.	
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	

2b Avg.= 5.00

Cumberland Fossil Plant

W029

Metric 2 Total 12.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	1

3d Avg.= 0.00

Cumberland Fossil Plant

W029

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
X	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	3
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 3.00

Cumberland Fossil Plant

Metric 3 Total 5.00

W029

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation __x__dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	2.00
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 2.50

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	3
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 3.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	3.00
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 3.00

Metric 4 Total 8.5

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	0

Cumberland Fossil Plant W029

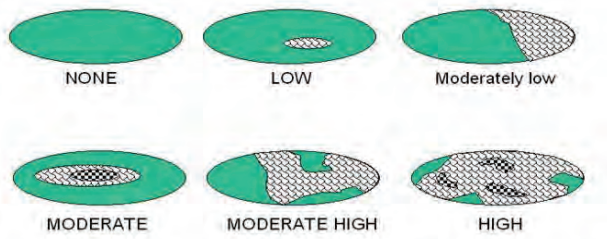

Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	**Narrative description**
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total -1

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	1
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	5
	Metric 4: Habitat	8.5
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	-1
	TOTAL SCORE	26

Cumberland Fossil Plant

W029
Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

W030

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

8/12/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	3
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
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25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 3

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.	7
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.	
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	
0pts	VERY NARROW. <10m (<32ft) around perimeter.	

2a Avg.= 7.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.	
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.	
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	

2b Avg.= 5.00

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Metric 2 Total 12.00

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	3
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	1
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	2
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 2.00

Cumberland Fossil Plant

W030

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
X	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	9.5
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 9.50

Cumberland Fossil Plant

Metric 3 Total 25.50

W030

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	4.00
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	0
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.=

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 9

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	1
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	2.00
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W030

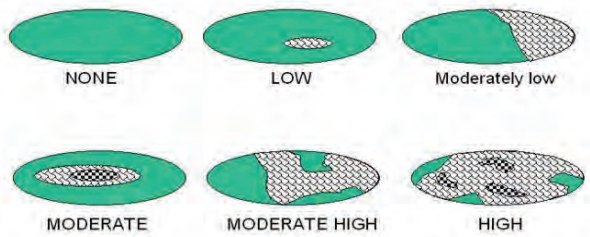


Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 4

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	3
	Metric 2: Buffers and surrounding land use	12
	Metric 3: Hydrology	25.5
	Metric 4: Habitat	9
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	4
	TOTAL SCORE	54

Cumberland Fossil Plant

W030
Rank = Moderate

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

W031-W040

8/10/2021

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	2
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 2

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.		
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.		
0pts	VERY NARROW. <10m (<32ft) around perimeter.	0	2a Avg.= 0.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.		
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	1	2b Avg.= 1.00

Cumberland Fossil Plant

W031-W040

Metric 2 Total 1.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	
5pts	Perennial surface water (lake or stream)	
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "…the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a p other nearby wetland or upland habitat areas.	
1pt	**Part of riparian corridor**.	
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	
2pts	0.4 to 0.7m (15.7 to 27.6in)	2
1pt	<0.4m (<15.7in)	
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	4
3pts	Regularly inundated or saturated	
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	1

3d Avg.= 2.50

Cumberland Fossil Plant

W031-W040

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

X	ditch(es), in or near the wetland	X	point source discharges to the (non-stormwater)
	tile(s), in or near the wetland	x	filling/grading activities in or near the wetland
	dike(s), in or near the wetland		road beds/RR beds in or near the wetland
	weir(s), in or near the wetland	x	dredging activities in or near the wetland
X	stormwater inputs (addition of water)	x	other (specify) on active fossil plant

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	1

3e Avg= 1.00

Cumberland Fossil Plant

Metric 3 Total 6.50

W031-W040

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation ____dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	1

4a Avg.= 1.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	1

4b Avg.= 1.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	1

4c Avg. = 1.00

Metric 4 Total 3

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points).	Score
6a. Wetland Vegetation Communities Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	1
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	1.00
0pt	NONE Wetland has no plan view interspersion	

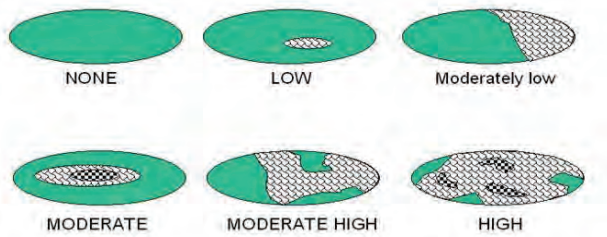


Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	Narrative description
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 2

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	2
	Metric 2: Buffers and surrounding land use	1
	Metric 3: Hydrology	6.5
	Metric 4: Habitat	3
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	2
	TOTAL SCORE	15

Cumberland Fossil Plant

W031-W040
Rank = Low

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

Cumberland Fossil Plant

Britta Lees

Quantitative Rating
Tennessee Rapid Assessment Method

W041a,b,c

8/10/2021

Metric 1. Wetland area (max 6 pts). Estimate the area of wetland and select the appropriate size class and assign score. Estimated areas should clearly place the wetland within the appropriate class.

6pts	>50 acres (west TN)	>25 acres (middle TN)	>10 acres (east TN *)	
5pts	25 - <50 acres (west TN)	10- 25 acres (middle TN)	7-<10 acres (east TN*)	
4pts	10 - <25 acres (west TN)	7-< 25acres (middle TN)	3-<7 acres (east TN*)	4
3pts	3 - <10 acres(west TN)	3< 7 acres (middle TN)	1-<3 acres (east TN)	
2pts	0.3 - <3 acres (west TN)	0.5- <3 acres (middle TN)	0.5-<1 acres (east TN)	
1pt	0.1 - <0.3 acres(west TN)	<0.5 acres (middle TN)	<0.5 acres (east TN)	

*More applicable to West Tennessee; use with discretion in Middle Tennessee, Consult TDEC-DWR Natural Resources Unit for use in East Tennessee.

Table 2. Metric to English conversion table with visual estimation sizes.

acres	ft^2	yd^2	ft on side	yd on side	ha	m^2	m on side
50	2,177,983	241,998	1476	492	20.2	202,000	449
25	1,088,992	120,999	1044	348	10.1	101,000	318
10	435,596	48,340	660	220	4.1	41,000	203
3	130,679	14,520	362	121	1.2	12,000	110
0.3	13,067	1,452	114	38	0.12	1,200	35
0.1	4,356	484	66	22	0.04	400	20

Metric 1 Total 4

Metric 2. Upland buffers and intensity of surrounding land uses (Max 14 points). Wetlands without upland "buffers", or that are located where human land use is more intensive, are often, but not always, more degraded and often have lower wildlife habitat resource value.

2a. Average Buffer Width (ABW). Calculate the average buffer width and select only one score. To calculate ABW, estimate buffer width on each side (max of 50m) and divide by the number of sides. Example: ABW of a wetland with buffers of 100m, 25m, 10m and 0m would be calculated as follows: ABW = (50m + 25m + 10m + 0m)/4 = 21.25m. Intensive land uses are not buffers, e.g. active row cropping, paved areas, housing developments, etc.

7pts	WIDE. >50m (164ft) or more around perimeter.		
4pts	MEDIUM. 25m to <50m (82 to <164ft) around the perimeter.		
1pt	NARROW. 10m to <25m (32 to <82ft) around the perimeter.	1	
0pts	VERY NARROW. <10m (<32ft) around perimeter.		2a Avg.= 1.00

2b. Intensity of predominant surrounding land use(s) Select one, or choose up to two and average score, for the intensity of the predominant land use(s) outside the wetland's buffer zone.

7pts	VERY LOW. 2nd growth or older forest, prairie, barren, wildlife area, etc.		
5pts	LOW. Old fallow field, shrub land, early successional young forest, etc.	5	
3pts	MODERATELY HIGH. Residential, pasture, orchard, park, conservation tillage, mowed field, etc.		
1pt	HIGH. urban, industrial, row cropping, mining, construction, etc.	1	2b Avg.= 3.00

Cumberland Fossil Plant

W041a,b,c

Metric 2 Total 4.00

Quantitative Rating
Tennessee Rapid Assessment Method

Metric 3. Hydrology (Max 30 points). This metric evaluates the wetland's water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and the degree to which the wetland's hydrology has been altered by human activity**. A wetland can receive no more than 30 points for Metric 3 even though it is possible to score more than 30 points.**

3a. Sources of Water. Select all that apply and sum the score. This question relates to a wetland's water budget. It also is reflective that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values.		
5pts	High pH groundwater (7.5-9.0)	
3pts	Other groundwater	
1pts	Precipitation	1
3pts	Seasonal surface water	
5pts	Perennial surface water (lake or stream)	5
3b. Connectivity. Select all that apply and sum score		
1pt	**100 year floodplain.** "Floodplain" is defined as "...the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods." Where they are available, flood insurance rate maps (FIRMs) and flood boundary and floodway maps may be used.	1
1pt	**Between stream/lake and other human land use.** This question asks whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through wetland before it discharges into the surface water buffering it. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.	1
1pt	**Part of a larger wetland or upland complex.** This question asks whether the wetland is in physical proximity to, or a other nearby wetland or upland habitat areas.	1
1pt	**Part of riparian corridor**.	1
3c. Maximum water depth. Select only one and assign score. The evaluator *does not* need to actually observe the wetland when its water depth is greatest in order to award the maximum points for this question. The use of secondary indicators, as outlined in the 1987 Manual will be useful in answering this question.		
3 pts	>0.7m (27.6in)	3
2pts	0.4 to 0.7m (15.7 to 27.6in)	
1pt	<0.4m (<15.7in)	
3d. Duration of inundation/saturation. Select one or double check and average the scores if duration is uncertain. The use of ACOE 1987 Manual secondary indicators is necessary and expected in order to properly answer this question.		
4pts	Semi-permanently to permanently inundated or saturated	
3pts	Regularly inundated or saturated	3
2pts	Seasonally inundated	
1pt	Seasonally saturated in the upper 30cm (12in) of soil	

3d Avg.= 3.00

Cumberland Fossil Plant

W041a,b,c

3e. Modifications to natural hydrologic regime. Check all observable modifications from list below. Score by selecting the most appropriate description of the wetland. Scores may be double checked and averaged. This question asks the evaluator to assess the "intactness" of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated.

Once the evaluator has listed all possible past and ongoing disturbances, the evaluator should check the most appropriate category to describe the present state of the wetland. In instances where the evaluator believes that a wetland falls between two categories, or where the evaluator is uncertain as to which category is appropriate, it is appropriate to choose more than one and average the score.

The evaluator may check one or several of these possible disturbances, yet still determine that the natural hydrologic regime is intact. However, see Metric 4 where these same disturbances may be habitat alterations.

Check all that are observed present in or near the wetland.

	ditch(es), in or near the wetland		point source discharges to the (non-stormwater)
	tile(s), in or near the wetland		filling/grading activities in or near the wetland
	dike(s), in or near the wetland	X	road beds/RR beds in or near the wetland
	weir(s), in or near the wetland		dredging activities in or near the wetland
	stormwater inputs (addition of water)		other (specify)

Have any of the disturbances identified above caused or appear to have caused more than trivial alterations to the wetland's natural hydrologic regime.	YES Assign a score 1, 3 or 7, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 12 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 9.5.

Select one or double check adjoining numbers and average the score.		**score**
12pts	NONE OR NONE APPARENT. There are no modifications or no modifications that are apparent to the evaluator.	
7pts	RECOVERED. The wetland appears to have recovered from past modifications.	7.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past modifications.	
1pt	RECENT OR NO RECOVERY. The modifications have occurred recently occurred, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.	

3e Avg= 7.00

Cumberland Fossil Plant

Metric 3 Total 23.00

W041a,b,c

Metric 4. Habitat Alteration and Development (Max 20 points). While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These disturbances are termed "habitat alteration." In many instances, items checked as hydrologic disturbances in Question 3e will present as alterations to a wetland's habitat or disruptions in its development (successional state). In some instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. To determine the appropriate metric scores, the evaluator should carefully determine the actual cause of the disturbance to the wetland.

4a. Substrate/Soil Disturbance. Select one or double check and average. This question evaluates physical disturbances to the soil and surface substrates of the wetland. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.	Examples of substrate/soil disturbance include (circle all that apply): ____filling and grading ____plowing ____grazing (hooves) ____vehicle use (off-road vehicles, construction vehicles) ____sedimentation __x__dredging, and other mechanical disturbances to the soil

Have any of soil or substrate disturbances caused or appear to have caused more than trivial alterations to the wetland's natural soils	YES Assign a score 1, 2 or 3, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 4 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 3.5.

Select one or double check adjoining numbers and average the score.		
4pts	NONE OR NONE APPARENT. There are no disturbances or no disturbances apparent to the evaluator.	
3pts	RECOVERED. The wetland appears to have recovered from past disturbances.	3.00
2pts	RECOVERING. The wetland appears to be in the process of recovering from past disturbances.	
1pt	RECENT OR NO RECOVERY. The disturbances have occurred recently, and/or the wetland has not recovered from past disturbances, and/or the disturbances are ongoing.	

4a Avg.= 3.00

4b. Habitat development. Select only one and assign score. This question asks the evaluator to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically and/or hydrogeomorphically similar wetlands. This question presumes knowledge of the types of wetlands and the range in quality typical of the region or access to data from reference standard examples. If unsure, score as GOOD or MODERATELY GOOD.

7pts	EXCELLENT. Wetland appears to represent the best of its type or class.	
6pts	VERY GOOD. Wetland appears to be a very good example of its type or class but is lacking in characteristics which would make it excellent.	
5pts	GOOD. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, or other reasons, is not excellent.	5.00
4pts	MODERATELY GOOD. Wetland appears to be a fair to good example of its type or class.	
3pts	FAIR. Wetland appears to be a moderately good example of its type or class but because of past or present disturbances, successional state, etc. is not good.	
2pts	POOR TO FAIR. Wetland appears to be a poor to fair example of its type or class.	
1pt	POOR. Wetland appears not to be a good example of its type or class because of past or present disturbances, successional state, etc.	

4b Avg.= 5.00

4c. Habitat alteration. This question evaluates the "intactness" the natural habitat of the type of wetland that is being evaluated. This question does not discriminate between wetlands with different types of habitat. Check all possible alterations that are observed. All available information, field visits, aerial photos, maps, etc. can be used to identify possible alterations. Evaluate whether the alteration is trivial in relation to the wetlands overall habitat. Select the most appropriate score that best describes the present state of the wetland. It is appropriate to "double check" and average scores. **The evaluator may check one or several of these possible disturbances, yet still determine that the natural habitat is intact.**

Check all that are observed present in or near the wetland

	Mowing		Herbaceous layer/aquatic bed removal
	Grazing (cattle, horses, etc.)		Sedimentation
	Clearcutting		Dredging
	Selective cutting		Row-crop or orchard farming
	Woody debris removal		Nutrient enrichment, e.g. nuisance algae
	Toxic pollutants		Other (specify):
	Shrub/sapling removal		Other (specify):

Have any of the disturbances identified above caused or appeared to cause more than trivial alterations to the wetland's natural habitat.	YES Assign a score 1, 3 or 6, or an intermediate score, depending on degree of recovery from the disturbance.	NO Assign a score of 9 since there are no or no apparent modifications.	NOT SURE Choose "recovered" and assign a score of 6.

Select one score or double check adjoining numbers and average the score.		Score
9pts	NONE OR NONE APPARENT. There are no past or current alterations that are apparent to the evaluator.	
6pts	RECOVERED. The wetland appears to have recovered from past alterations.	6.00
3pts	RECOVERING. The wetland appears to be in the process of recovering from past alterations.	
1pt	RECENT OR NO RECOVERY. The alterations have occurred recently, and/or the wetland has not recovered from past alterations, and/or the alterations are ongoing.	

4c Avg. = 6.00

Metric 4 Total 14

Metric 5. Special wetland communities. Assign points in left column if the wetland meets the associated criteria below. Refer to Narrative Rating for guidance. If wetland scores over 30 points within Metric 5 further determination needed to assess if the wetland exhibits outstanding ecological or recreational values as discussed in the Narrative Rating Section.			
	5pts - >10m sq sphagnum or other moss or other vernal pools		5 pts - Superior fish, waterfowl, bat, or amphibian breeding habitat
	Ecological community with global rank (NatureServe): G1 (10pts), G2 (5pts), G2/G3 (3pts) or uncommon ecological resource in the ecoregion (habitat and/or species diversity, geology, wetland type, distribution/ occurrence) (10 pts)		5 pts - Wetland contains and is a buffer for a headwater stream or wetland contributes significantly to the water water quality of 303(d) listed stream and/or to surface or and/or to ground water
	10 pts - Older-aged mature forested wetland avg. DBH >= 30 inches		10 pts - Supports species Deemed in Need of Management by TWRA or TN Special Concern by TDEC

Metric 5 Total 0

Metric 6. Vegetation, Interspersion, and Microtopography (Max 20 points). **6a. Wetland Vegetation Communities** Check each community present both vertically and horizontally within the wetland with an area of at least 0.1 hectares or 1000m^2 (0.2471 acres). Assign a score of 0 to 3 using Table 3 for 1-4 or Table 5 for 5-6. Sum the scores for the classes present.	Score
1)Aquatic Bed Includes areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Floating aquatic species like duckweed (*Lemna* spp., *Spirodela* spp.) are excluded from definition of "aquatic bed." Aquatic beds often occur as a distinct zone as an "understory" below shrubs or trees.	
2)Emergent Includes areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, and fens.	2.00
3)Shrub Includes areas of wetlands dominated by woody vegetation less than 1m (3ft.) - 6m (20 ft) tall with a dbh of <3in. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable plant communities.	2
4)Forested Includes wetlands or areas of wetlands characterized by woody vegetation greater than 6m (20ft) or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands. Some forested wetlands are "vernal pools".	1
5)Mudflats The "mudflat" class is equivalent to the "unconsolidated bottom/mud" class/subclass (PUB$_3$) described in Cowardin et al. (1979) and includes areas of wetlands characterized by exposed or shallowly inundated substrates with vegetative cover less than 30%.	
6)Open water The "open water" class is equivalent to the "open water - unknown bottom" class in Cowardin et al. (1979) and includes areas that are 1) inundated, 2) un-vegetated, and 3) and "open", i.e. there is no "canopy" of any type of vegetation.	

Table 3. Use this table to assign a cover score for Metric 6a to each of the vegetation communities identified on the preceding page. Refer to Table 4 for narrative description of "low," "moderate," and "high" quality.

Cover Scale	Description
0	The vegetation community is either 1) absent from wetland or 2) Comprises less than 0.1 ha (.2471 acres) of contiguous area within the wetland
1	Vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of low or moderate quality, or 2) if it comprises a significant part of the wetland's vegetation and is of low quality
2	Thee vegetation community is present and either, 1) comprises a significant part of the wetland's vegetation and is of moderate quality, or 2) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3	The vegetation community is of high quality and comprises a significant part, or more, of the wetland's vegetation

Table 4. Use this table in conjunction with Table 3 to determine what is a "low", "moderate," or " high" quality community.

Narrative	Description
Low	Low species richness and a predominance of invasive, non-native, or disturbance tolerant "weedy" species.
Moderate	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant "weedy" species can also be present, and species richness is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and/or the presence of rare, threatened or endangered species.

Table 5. Mudflat and open water community cover scale.

0	Absent <0.1 ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 ha to < 4 ha (2.47 to 9.88 acres)
3	High 4 ha (9.88 acres) or more

6b. Horizontal (plan view) interspersion. Evaluate the wetland from a "plan view," i.e. as if the looking down upon it. See Figure 1.		Score
5pts	HIGH Wetland has a high degree of interspersion	
4pts	MODERATELY HIGH Wetland has a moderately high degree of interspersion	
3pts	MODERATE Wetland has a moderate degree of interspersion	3.00
2pts	MODERATELY LOW Wetland has a moderately low degree of interspersion	
1pt	LOW Wetland has a low degree of interspersion.	
0pt	NONE Wetland has no plan view interspersion	

Cumberland Fossil Plant W041a,b,c

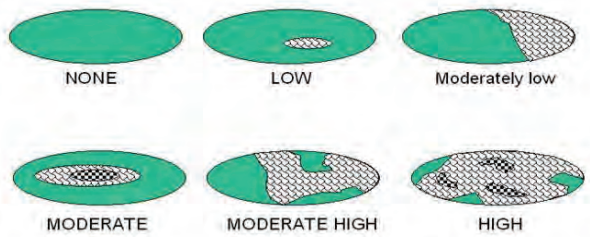


Figure 1. Hypothetical Wetlands for estimating degree of interspersion

6c. Coverage of Invasive Plant Species. Refer to Tennessee Exotic Pest Plant Council (http://www.tneppc.org/) for official list. Select only one and assign score.		Score
-5pts	Extensive >75% areal cover of invasive species	
-3pts	Moderate 25-75% areal cover of invasive species	
-1pts	Sparse 5-25% areal cover of invasive species	-1
0pt	Nearly absent. <5% areal cover of invasive species	
1pt	Absent	
6d. Microtopography. Check each feature present in the wetland. Assign cover score of 0 to 3 using Table 6. Evaluate various microtopograhic habitat features often present in wetlands.		Score
Vegetated hummocks and tussocks		
Coarse woody debris >15cm (6in) in diameter		
Standing dead trees >25cm (10in) diameter at breast height		
Amphibian breeding habitat, e.g. vernal pools with standing water of sufficient duration and depth to support reproduction, or habitat for frog reproduction		

Table 6. Cover scale for microtopographic habitat features

Microtopographic habitat quality	**Narrative description**
0	Feature is absent or functionally absent from the wetland
1	Feature is present in the wetland in very small amounts or if more common, of low quality
2	Feature is present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of the highest quality

Metric 6 Total 7

NON-HGM TRAM Summary Worksheet

Non-HGM Quantitative Rating	Metric 1: Size	4
	Metric 2: Buffers and surrounding land use	4
	Metric 3: Hydrology	23
	Metric 4: Habitat	14
	Metric 5: Special Wetland Communities	0
	Metric 6: Plant communities, interspersion, microtopography	7
	TOTAL SCORE	52

Cumberland Fossil Plant

W041a,b,c **Rank = Moderate**

"Wetland Conditions with an overall score of 100-75 are considered Exceptional Tennessee Waters. Wetlands with a score of 74-45 are considered to have moderate resource value, and wetland with a score of 44 and below have a low resource value."
(TRAM 2015, pg 2)

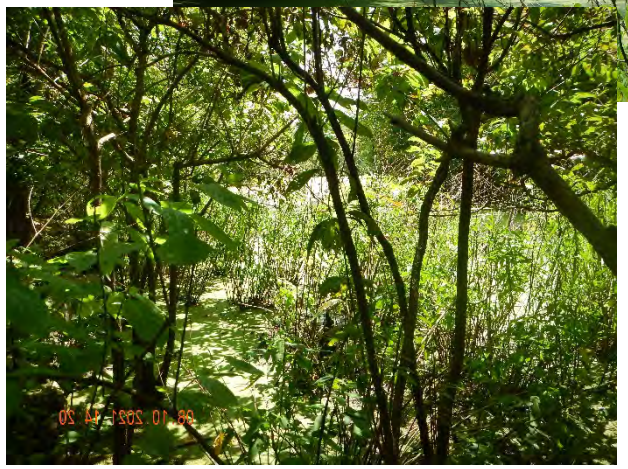
Appendix C

Wetland Photograph

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog



W001a,b,c Scrub-shrub/Forested/Unconsolidated Bottom, 2.14 acres, Moderate TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

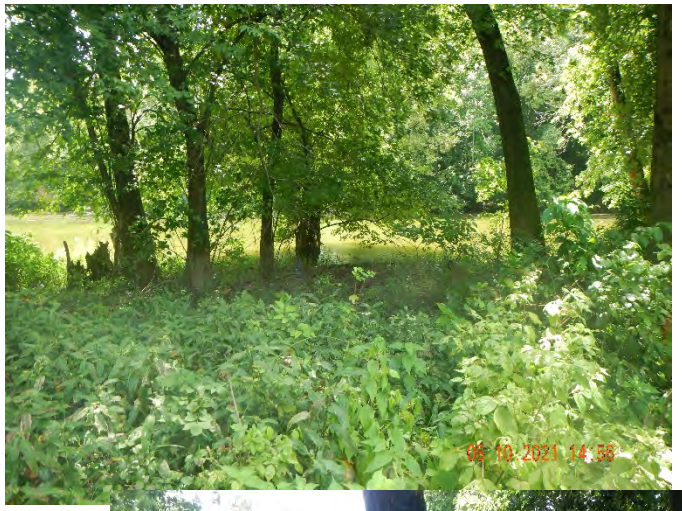
Wetland Photolog

W002 Forested/Emergent, 2.32 acres, Moderate TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog



W003 Forested, 0.76 acres, Moderate TRAM Value

W004 Forested, 0.11 acres, Low TRAM Value, No Photos

W005 Forested, 3.48 acres, Moderate TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog

W006 Forested/Emergent/Scrub-shrub, 0.39 acres, Low TRAM Value

W007 Emergent/Scrub-shrub, 3.55 acres, Moderate TRAM Value

W008 Emergent, 0.34 acres, Moderate TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog

W009 Emergent, 3.45 acres, Moderate TRAM Value

W010 Emergent/Scrub-shrub/Forested, 18.46 acres, Moderate TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog

W011a-z Forested/Emergent/Scrub-shrub, 80.17 acres, Moderate TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog

W012 Forested, 1.11 acres, Moderate TRAM Value

W013a,b Forested/Emergent, 0.11 acres, Low TRAM Value

W014 Scrub-shrub, 1.11 acres, Low TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog

W015 Forested/Emergent/Scrub-shrub, 0.14 acres, Low TRAM Value

W016 Emergent, 0.03 acres, Low TRAM Value

W017a-e Emergent/Forested, 1.10 acres, Low TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog

W018a,b Forested/Emergent, 0.47 acres, Low TRAM Value

W020 Emergent, 0.11 acres, Low TRAM Value

W019a-c Forested/Emergent, 3.70 acres, Moderate TRAM Value

W021 Emergent/Forested, 0.68 acres, Moderate TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog

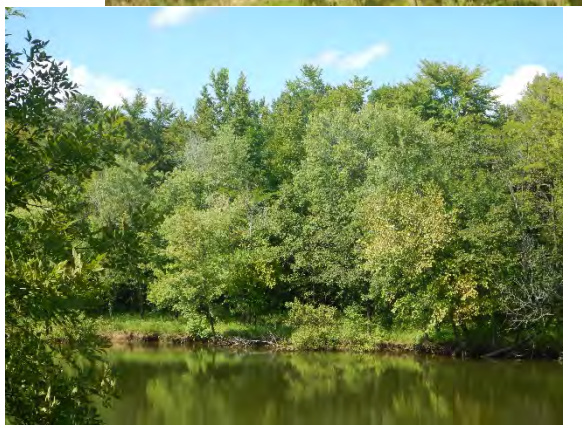
W022 Forested, 0.19 acres, Low TRAM Value

W025 Forested/Scrub-shrub, 0.73 acres, Moderate TRAM Value

W023 Forested, 1.84 acres, Moderate TRAM Value, No Photos

W024 Forested/Scrub-shrub, 0.79 acres, Moderate TRAM Value, No Photos

W027 Forested, 1.93 acres, Moderate TRAM Value, No Photos



W026 Forested, 6.86 acres, Moderate TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog

W028 Forested, 1.84 acres, Moderate TRAM Value

W029 Forested, 0.17 acres, Low TRAM Value, No Photos

W030 Forested, 4.43 acres, Moderate TRAM Value, No Photos

W032 Emergent, 0.75 acres, Low TRAM Value

W031 Emergent, 0.06 acres, Low TRAM Value

W033 Emergent, 0.27 acres, Low TRAM Value

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog

W034 Emergent, 0.31 acres, Low TRAM Value

W037 Scrub-shrub/Emergent, 0.03 acres, Low TRAM Value

W035 Emergent/Unconsolidated Bottom, 0.94 acres, Low TRAM Value

W036 Emergent, 0.08 acres, Low TRAM Value, No Photos

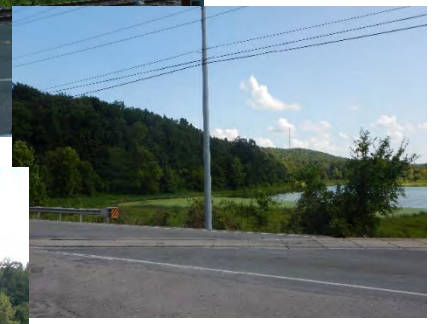
W039 Emergent, 0.84 acres, Low TRAM Value, No Photos

W040 Emergent, 0.38 acres, Low TRAM Value, No Photos

Cumberland Fossil Retirement EIS

Wetland Assessment 2021

Wetland Photolog



W041a-c Forested/Emergent/Scrub-shrub, 26.47 acres, Moderate TRAM Value

W038 Emergent, 0.68 acres, Low TRAM Value

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
3701 Bell Road
NASHVILLE, TENNESSEE 37214

REPLY TO
ATTENTION OF:

OCT 0 2 2017

Regulatory Division

SUBJECT: File No. LRN-2017-00257; Preliminary Jurisdictional Determination for TVA Cumberland City Fossil Plant Proposed Landfill and Borrow Area located along Wells Creek, in Cumberland City, Stewart County, Tennessee

Mr. Mike Stiefel
TVA – Water Permitting and Compliance
1101 Market Street – BR 4A
Chattanooga, Tennessee 37402

Dear Mr. Stiefel:

This letter is in regard to a Preliminary Jurisdictional Determination (PJD) request for property located at TVA Cumberland City Fossil Plant proposed for landfill and borrow area expansion, located along Wells Creek, in Cumberland City, Stewart County, Tennessee (latitude 36.3808; longitude-87.6749). The property being reviewed is approximately 800-acres in size and shown on the attached location map. This project has been assigned Department of the Army (DA) File #LRN-2017-00257. Please refer to this number in all future correspondence regarding this project.

The U.S. Army Corps of Engineers (USACE) has regulatory responsibilities pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403). Under Section 10, the USACE regulates any work in, or affecting, navigable waters of the U.S. No navigable waterways are located within the property boundaries as shown on the enclosed location map. Under Section 404, the USACE regulates the discharge of dredge and/or fill material into waters of the U.S. (WOUS) including wetlands.

Based on information available and a stream review of the property, this office has determined that approximately 5,440 linear feet of perennial streams, 1,670 linear feet of intermittent streams, 8,060 linear feet of ephemeral streams, and 140.13 acres of wetlands were documented within the project review area. These features **may be** jurisdictional WOUS in accordance with 33 CFR 331.2 and a PJD has been prepared (Enclosure 1). This PJD is non-binding, cannot be appealed and only provides a written indication that WOUS may be present on-site. For purposes of computation of impacts, compensatory mitigation requirements, if necessary, and other resource protection measures, a permit decision made on the basis of a PJD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional WOUS.

Four pond areas (labeled PD-1, 2, 3, and 4) are located within the property and are included in the PJD as potential WOUS; however, these features are currently being evaluated as an Approved Jurisdictional Determination (AJD). If the AJD evaluation verifies these as isolated features, they would not be considered jurisdictional WOUS. The AJD review areas are shown on the enclosed

location map and correspondence regarding the AJD verification of these features will be provided upon completion of their evaluation.

Enclosed with this letter is a copy of the PJD form (Enclosure 1) and Request for Appeal (RFA) form (Enclosure 2) that explains available options regarding this determination. This determination is only valid for the review area shown on the attached location map labeled "TVA Property/Review Area for PJD and AJD Purposes for Proposed Landfill and Borrow Area Locations" (Enclosure 3).

If you agree with the findings of this PJD and understand your options regarding the same, please sign and date the form and return it to this office within 30 days from the date of this letter.

If you wish, you may request an approved jurisdictional determination (which may be appealed) by contacting this office. Also, you may provide new information for further consideration by the Corps to re-evaluate the PJD.

You can submit the signed copy of the PJD and/or contact Amy Robinson if you have questions in regards to this matter, at the letterhead address above, telephone 615-369-7507, fax 615-369-7501, or email amy.m.robinson@usace.army.mil.

Sincerely,

Timothy C. Wilder
Chief, West Branch
Regulatory Division
U.S. Army Corps of Engineers

Copy Furnished:
Mr. Stan Rudzinski
Amec Foster Wheeler Environmental
3800 Ezell Road, Suite 100
Nashville, TN 37211

Enclosures:
1 - Preliminary Jurisdictional Determination Form
2 – Request for Appeal (RFA) Form
3 – Location Map of Review Area for PJD and AJD Purposes

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): September 20, 2017

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:
Applicant: Tennessee Valley Authority (TVA), Cumberland Fossil Plant, 1101 Market Place, Chattanooga, TN 37402
Consultant: Amec, Foster, Wheeler Environmental & Infrastructure, Inc., 3800 Ezell Road, Suite 100, Nashville, TN 37211

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:
Nashville District, Regulatory (RD); Cumberland Fossil Plant, Landfill and Borrow Areas, Cumberland City, Stewart County, TN; File #LRN-2017-00257

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION: (SEE THE ATTACHED TABLE FOR MULTIPLE WATERBODIES AT DIFFERENT SITES)
State: TN County/parish/borough: Stewart City: Cumberland City

Center coordinates of site (in degree decimal format): Lat. 36.3808°; Long.-87.6749°
Universal Transverse Mercator:

Name of nearest waterbody: Wells Creek

Identify (estimate) amount of waters in the review area: perennial, intermittent, and ephemeral
Non-wetland waters: approx 5,440 linear feet of perennial, 1,670 linear feet of intermittent, and 8,160 linear feet of ephemeral channel
Cowardin Class: R3, R4, and R6
Stream Flow: perennial, intermittent, and ephemeral
Wetlands: 143.5 acres (includes 5.5 acres to be further reviewed as AJD)
Cowardin Class: PEM and PFO

Name of any water bodies on the site that have been identified as Section 10 waters:
Tidal:
Non-Tidal:

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
X Office (Desk) Determination. Date: September 27, 2017

X Field Determination. Date(s): May 22, 2017

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is herby advised of his or her option to request and obtain an approved jurisdictional determination n(JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable. This preliminary JD finds that there *"may be"* waters of the of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

.'ORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should ,ncluded in case file and, where checked and requested, appropriately reference sources below):

X Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant:
Maps and plans provided by TVA and Amec Foster Wheeler, Inc.

X Data sheets prepared/submitted by or on behalf of the applicant/consultant.
X Office concurs with data sheets/delineation report.
Revisions submitted 7/28/2017 and 9/20/2017.

Office does not concur with data sheets/delineation report.

Data sheets prepared by the Corps:

X Corps navigable waters' study: Section 10 Navigable waterway list

U.S. Geological Survey Hydrologic Atlas: .
USGS NHD data.
USGS 8 and 12 digit HUC maps.

X U.S. Geological Survey map(s). Cite scale & quad name: Cumberland City quadrangle

X USDA Natural Resources Conservation Service Soil Survey: dated 12/29/2016

X National wetlands inventory map(s): dated 12/29/2016

State/Local wetland inventory map(s):

X FEMA/FIRM maps: dated 12/29/2016
100-year Floodplain Elevation (National Geodectic Vertical Datum of 1929)

X Photographs: Aerial (Name & Date): Google Earth, Sep 2015
or Other (Name & Date): Aerials provided by consultant (dated March 2016)

Previous determination(s). File no. and date of response letter:

X Other information (please specify): Onsite inspection by RD on 5/22/2017. TVA's Wetlands Section provided information for previous wetland delineation performed by TVA.

IMPORTANT NOTICE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations:

9/28/17

Signature and Date of
Regulatory Project Manager
(REQUIRED)

Signature and Date of
person requesting preliminary JD
(REQUIRED, unless obtaining
the signature is impracticable).

SITES REVIEWED/ POTENTIAL WATERS OF U.S. FOR PRELIMINARY JD: File #LRN-2017-00257

Site Number:	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area:	Class of aquatic resource:
W-1	36.38881	-87.68282	PEM	1.60 acres	Wetland; Non Sec 10
W-2	36.38894	-87.38001	PEM	0.03 acres	Wetland; Non Sec 10
W-3	36.38772	-87.67856	PEM	2.30 acres	Wetland; Non Sec 10
W-4	36.38753	-87.67653	PEM	2.30 acres	Wetland; Non Sec 10
W-5	36.38133	-87.67874	PEM	1.30 acres	Wetland; Non Sec 10
W-6	36.38232	-87.66673	PEM/PFO	111.40 acres	Wetland; Non Sec 10
W-7	36.37941	-87.66847	PEM	3.30 acres	Wetland; Non Sec 10
W-8	36.37950	-87.67114	PEM	11.0 acres	Wetland; Non Sec 10
W-12	36.38701	-87.67776	PFO	6.90 acres	Wetland; Non Sec 10
STR-1	36.372076	-87.681962	R4	1,280 linear feet	Intermittent; Non Sec 10
STR-2	36.380478	-87.682285	R3	4,600 linear feet	Perennial; Non Sec 10
STR-3	36.387501	-87.678112	R3	700 linear feet	Perennial; Non Sec 10
STR-4	36.387302	-87.678550	R3	140 linear feet	Perennial; Non Sec 10
STR-5	36.380464	-87.674734	R4	250 linear feet	Intermittent; Non Sec 10
STR-6	36.380817	-87.675059	R4	140 linear feet	Intermittent; Non Sec 10
WWC-1	36.374658	-87.675098	R6	1,230 linear feet	Ephemeral; Non Sec 10
WWC-2	36.374363	-87.674693	R6	800 linear feet	Ephemeral; Non Sec 10
WWC-3	36.377873	-87.670522	R6	150 linear feet	Ephemeral; Non Sec 10
WWC-4	36.378173	-87.673806	R6	1,930 linear feet	Ephemeral; Non Sec 10
WWC-5	36.375508	-87.682265	R6	410 linear feet	Ephemeral; Non Sec 10
WWC-6	36.377614	-87.685471	R6	1,070 linear feet	Ephemeral; Non Sec 10
WWC-7	36.378568	-87.683766	R6	250 linear feet	Ephemeral; Non Sec 10
WWC-8	36.384511	-87.679605	R6	1,030 linear feet	Ephemeral; Non Sec 10
WWC-9	36.383450	-87.672045	R6	330 linear feet	Ephemeral; Non Sec 10
WWC-11	36.380269	-87.675740	R6	860 linear feet	Ephemeral; Non Sec 10
PND-1	36.375686	-87.675712	PO	2.0 acres	Pond; Non Sec 10 (AJD review)
PND-2	36.376542	-87.673370	PO	2.10 acres	Pond; Non Sec 10 (AJD review)
PND-3	36.380988	-87.675278	PO	0.90 acres	Pond; Non Sec 10 (AJD review)
PND-4	36.380735	-87.674819	PO	0.50 acres	Pond; Non Sec 10 (AJD review)

ENCLOSURE 2

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: TVA Cumberland City Fossil Plant	File Number: LRN-2017-00257	Date:
Attached is:		See Section:
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
	APPROVED JURISDICTIONAL DETERMINATION	D
X	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/CECW/Pages/reg_materials.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

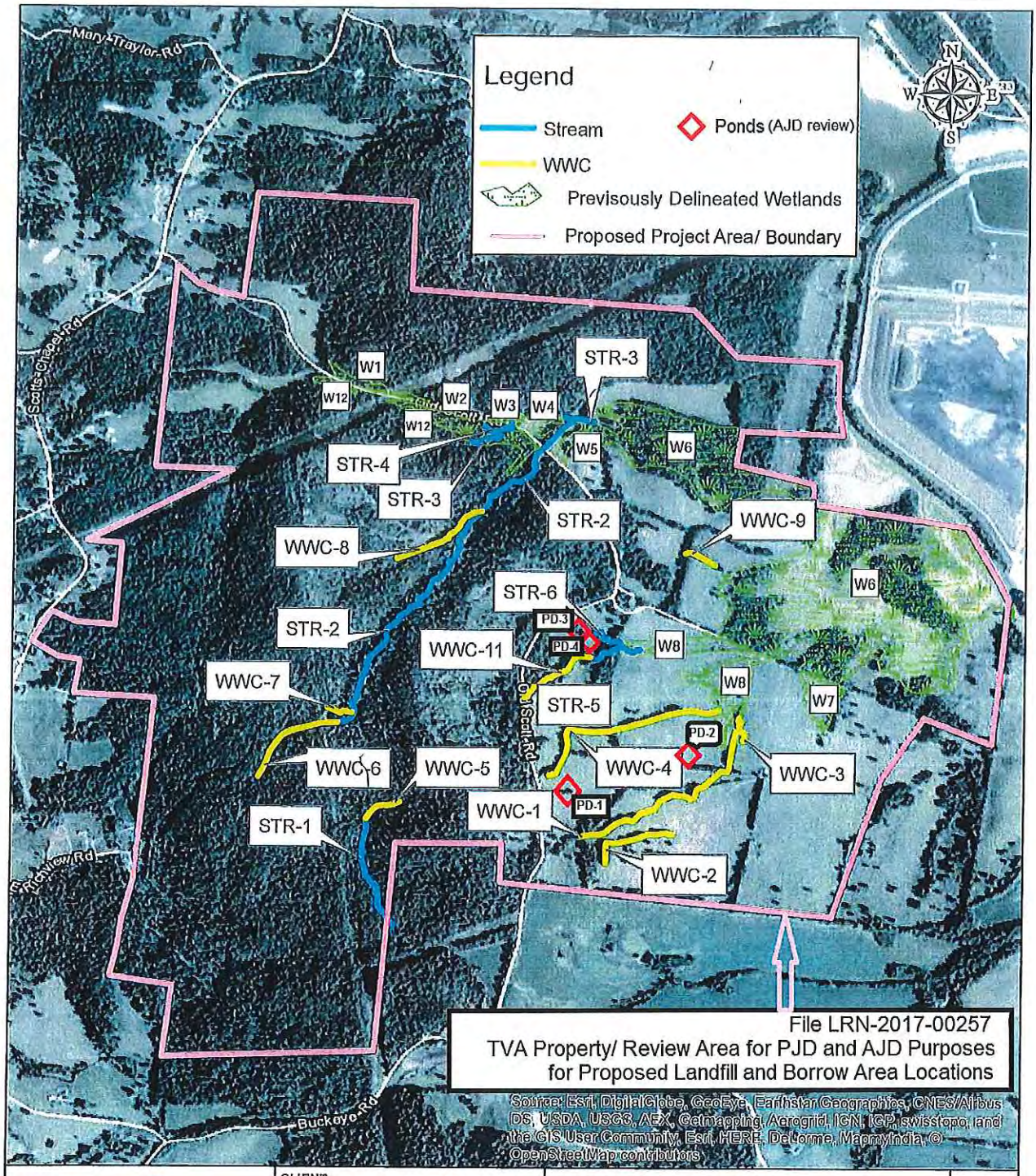
ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:	If you only have questions regarding the appeal process you may also contact: **Appeal Officer** **U.S. Army Corps of Engineers** **Great Lakes and Ohio River Division** **ATTN: Appeal Review Officer** **550 Main Street RM 10032** **Cincinnati, OH 45202-3222** **Telephone: 513-684-6212; Fax 513-684-2460**

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

Signature of appellant or agent.	Date:	Telephone number:



amec foster wheeler	CLIENT: Tennessee Valley Authority	SITE LOCATION: TVA Cumberland Fossil Plant Proposed Landfill and Borrow Areas Cumberland City, Stewart County, Tennessee	Figure No.
Amec Foster Wheeler Environment & Infrastructure, Inc. 3800 Ezell Road, Suite 100 Nashville, TN 37211	TITLE: Jurisdictional Stream and Wetland Location Map	SCALE: 1" = 2000' DATE: 05/30/2017 Project Number: 326216056.04.01 DRAWN BY: F. Glover CHECKED BY: S. Rudzinski ESRI TOPOGRAPHIC MAP	

Appendix G – Alternative A Pipeline Surface Waters Map

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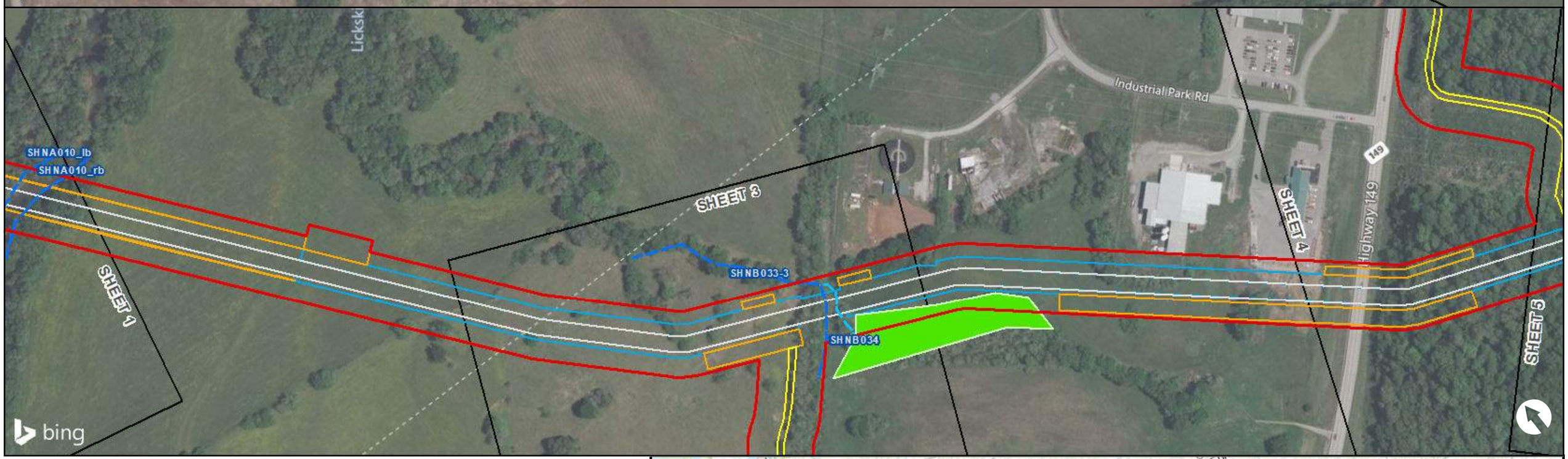

LEGEND

- Alt A Pipeline Corridor
- Surveyed Streams
  - Wet Weather Conveyance/Ephemeral
  - Stream/Intermittent
  - Stream/Perennial
- Surveyed Waterbodies
  - Pond
- Surveyed Wetlands
  - Palustrine Emergent
  - Palustrine Forested
- Contractor Yard
- MLV Site
- Cumberland Meter Station
- Proposed Pressure Regulation Station
- Permanent Easement
- Temporary Workspace
- Additional Temporary Workspace
- Access Road

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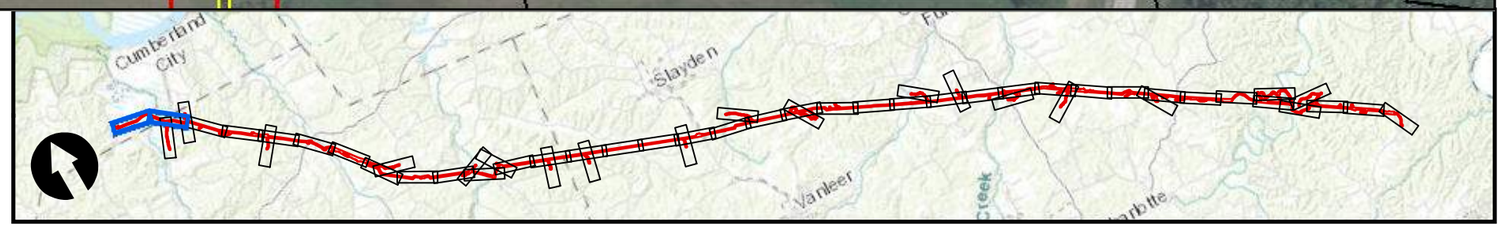

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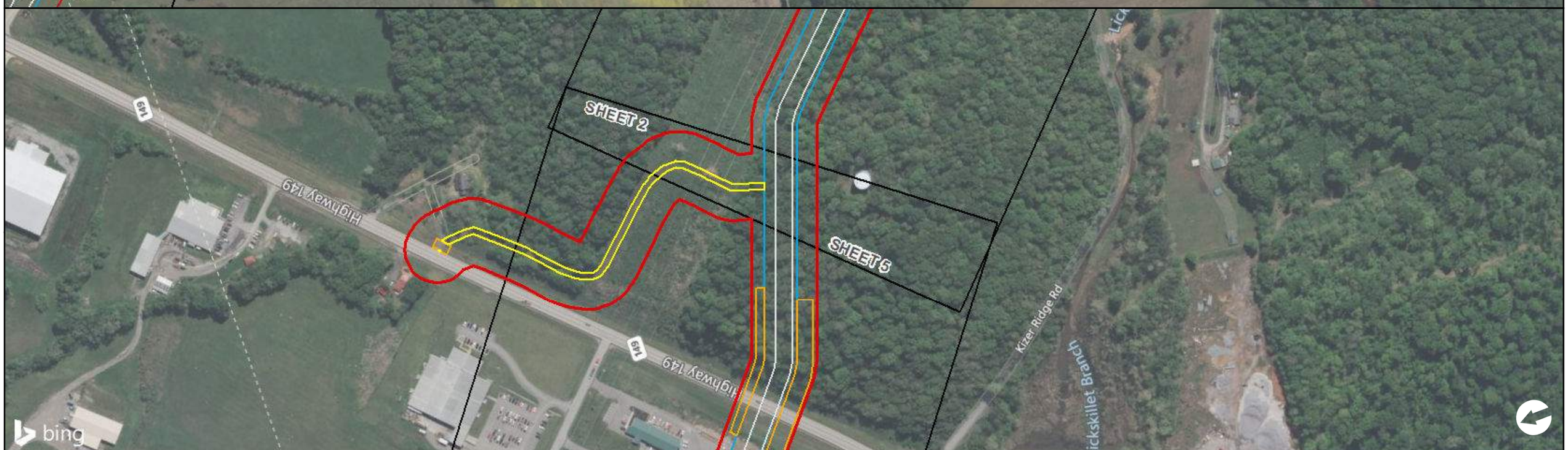

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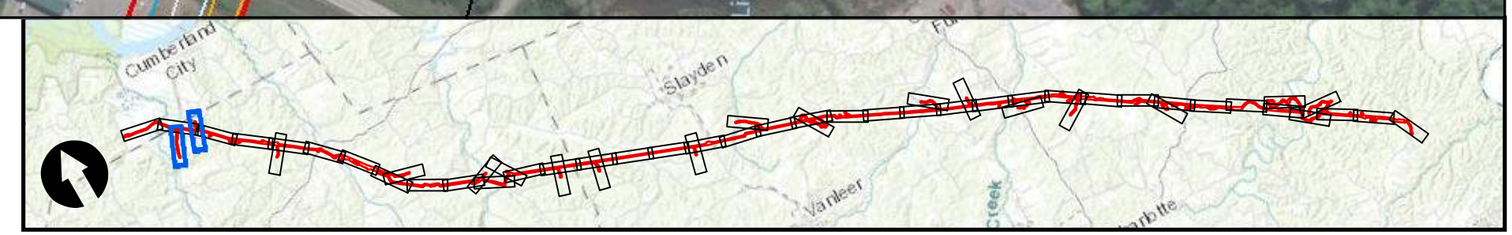

DATA SOURCE: Kinder Morgan Resource Report; Bing Hybrid Aerial Imagery

SHEET 5
SHEET 2
SHEET 4
SHEET 6
WHNA001
SHNA013
SHNB032
SHNB033-2
SHNA008
SHNA008
SHNA008
Kizer Ridge Rd
Kizer Ridge Rd
Kizer Ridge Rd
Lickskillet Branch
Lickskillet Branch
Lickskillet Branch
Branch Rd
bing

SHEET 5
Pulley Hollow Ln
Lickskillet Branch
Lickskillet Branch
SHNB033-1
SHNB030
SHEET 8
bing

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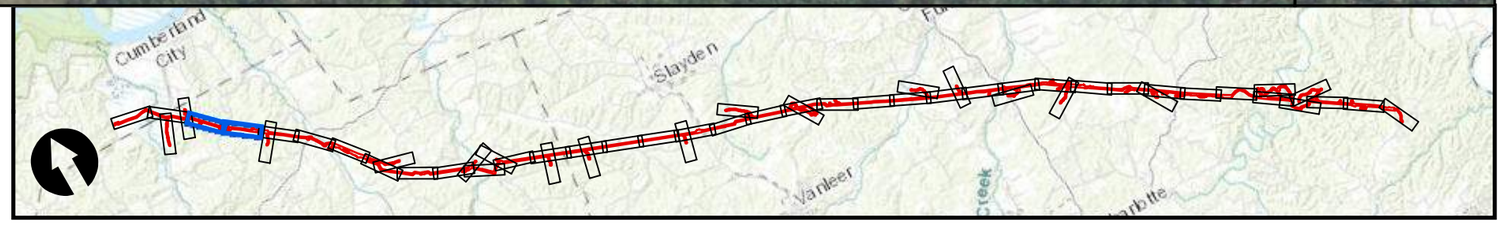

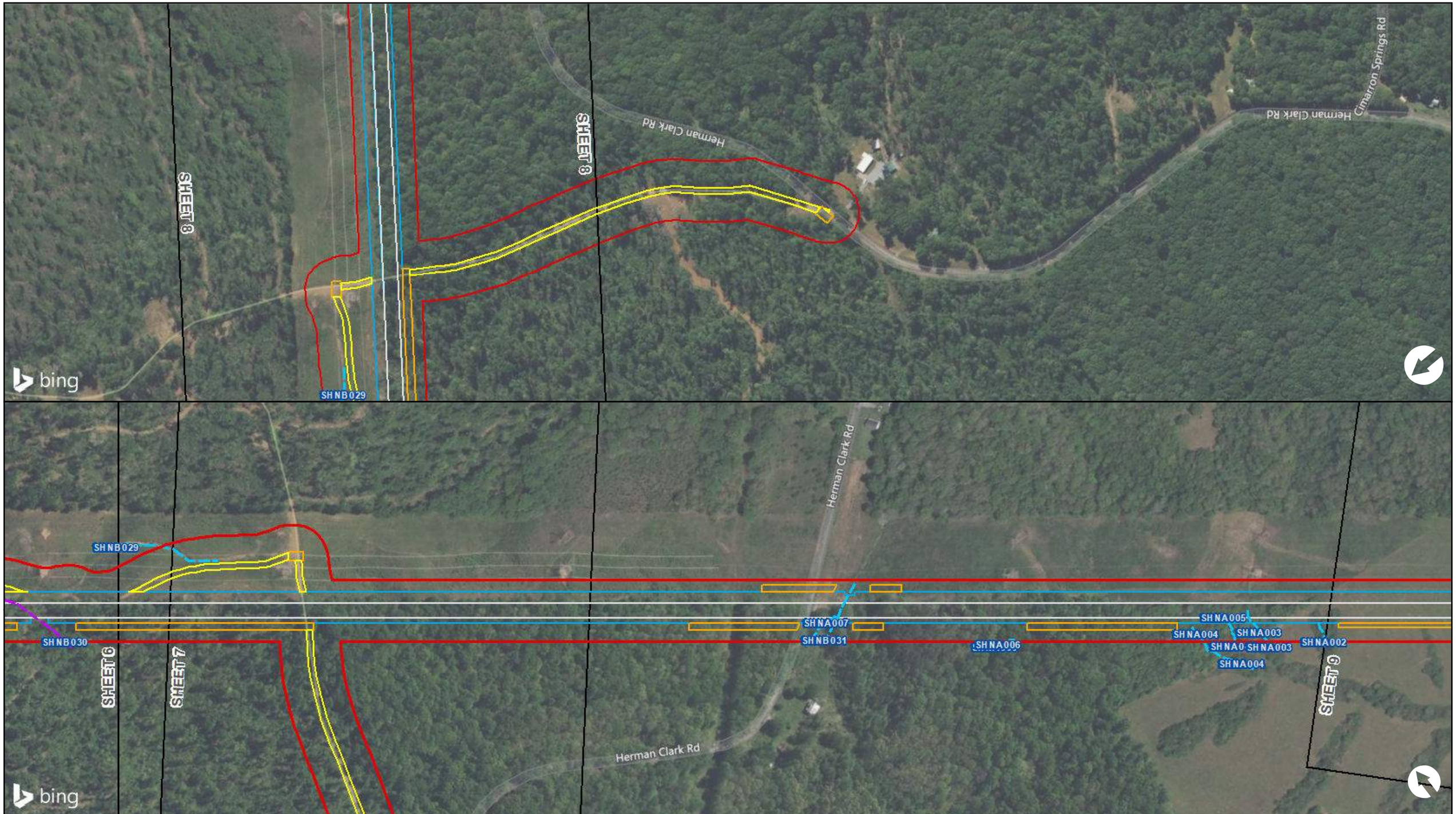

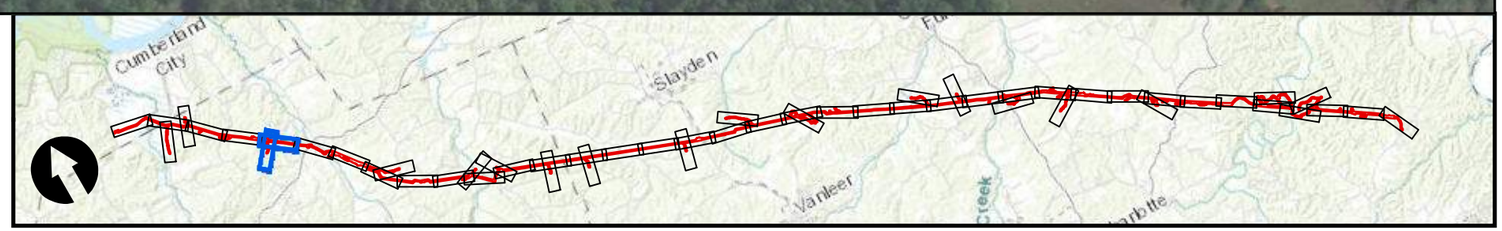

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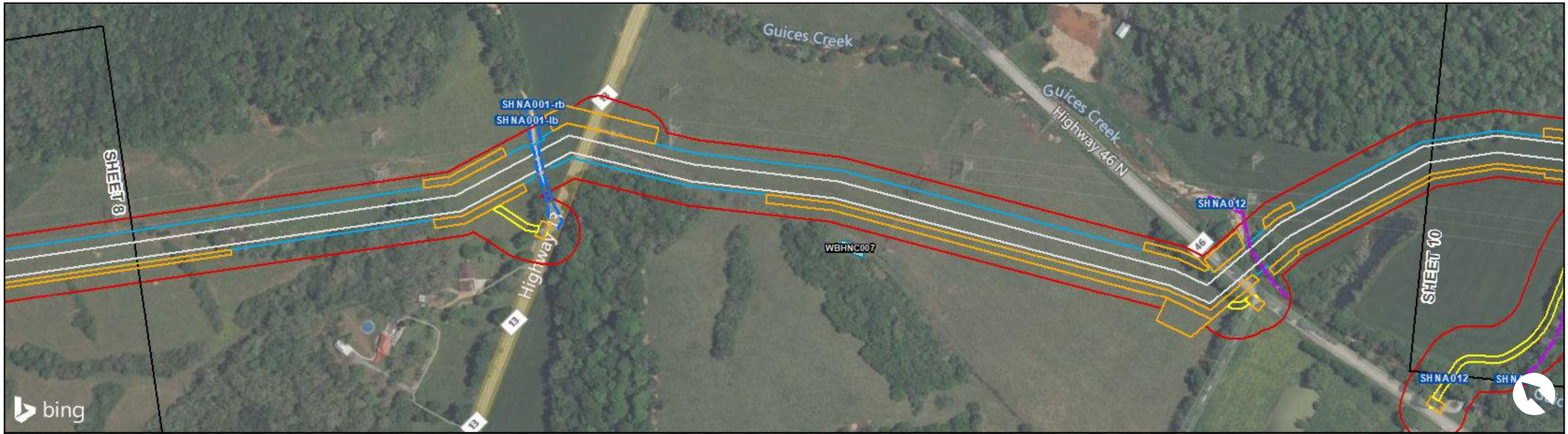
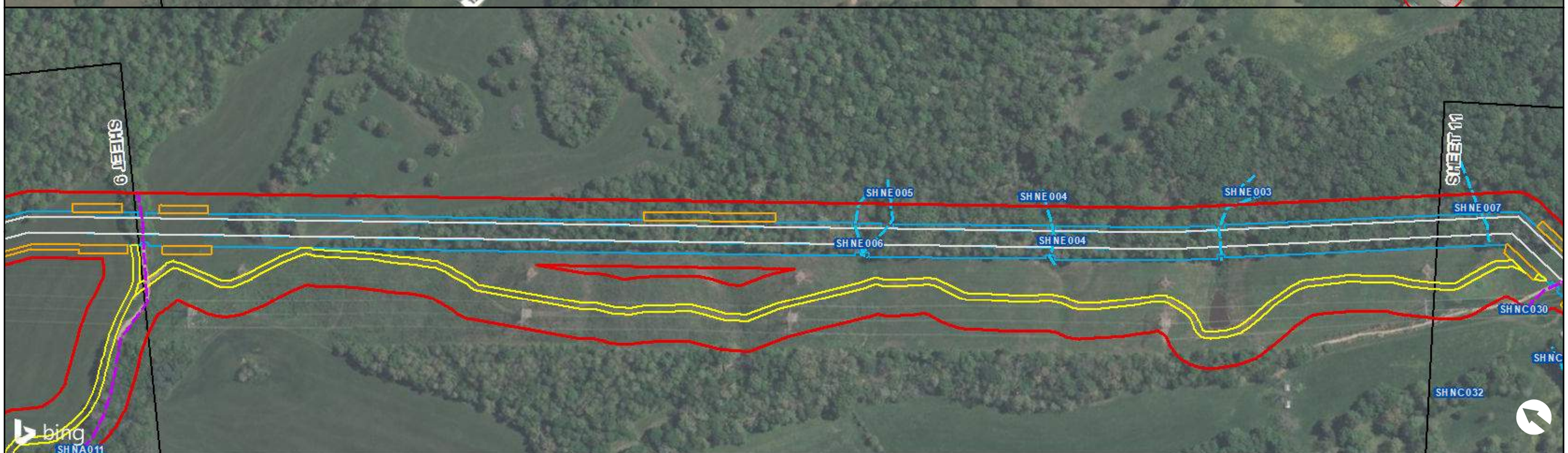
DATA SOURCE: Kinder Morgan Resource Report; Bing Hybrid Aerial Imagery





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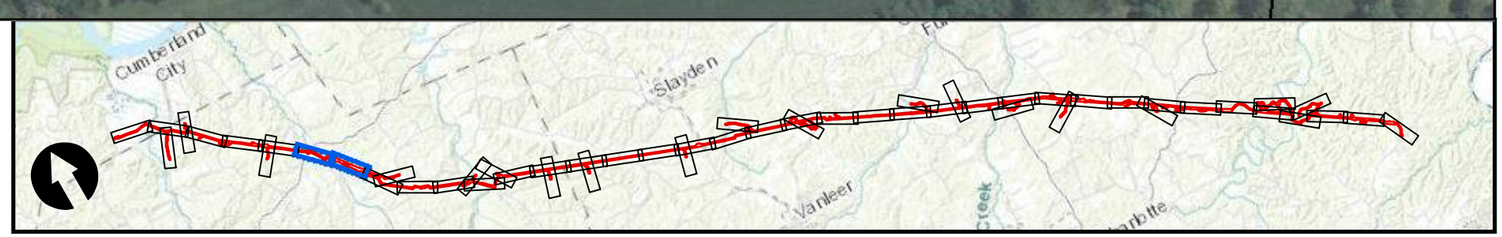

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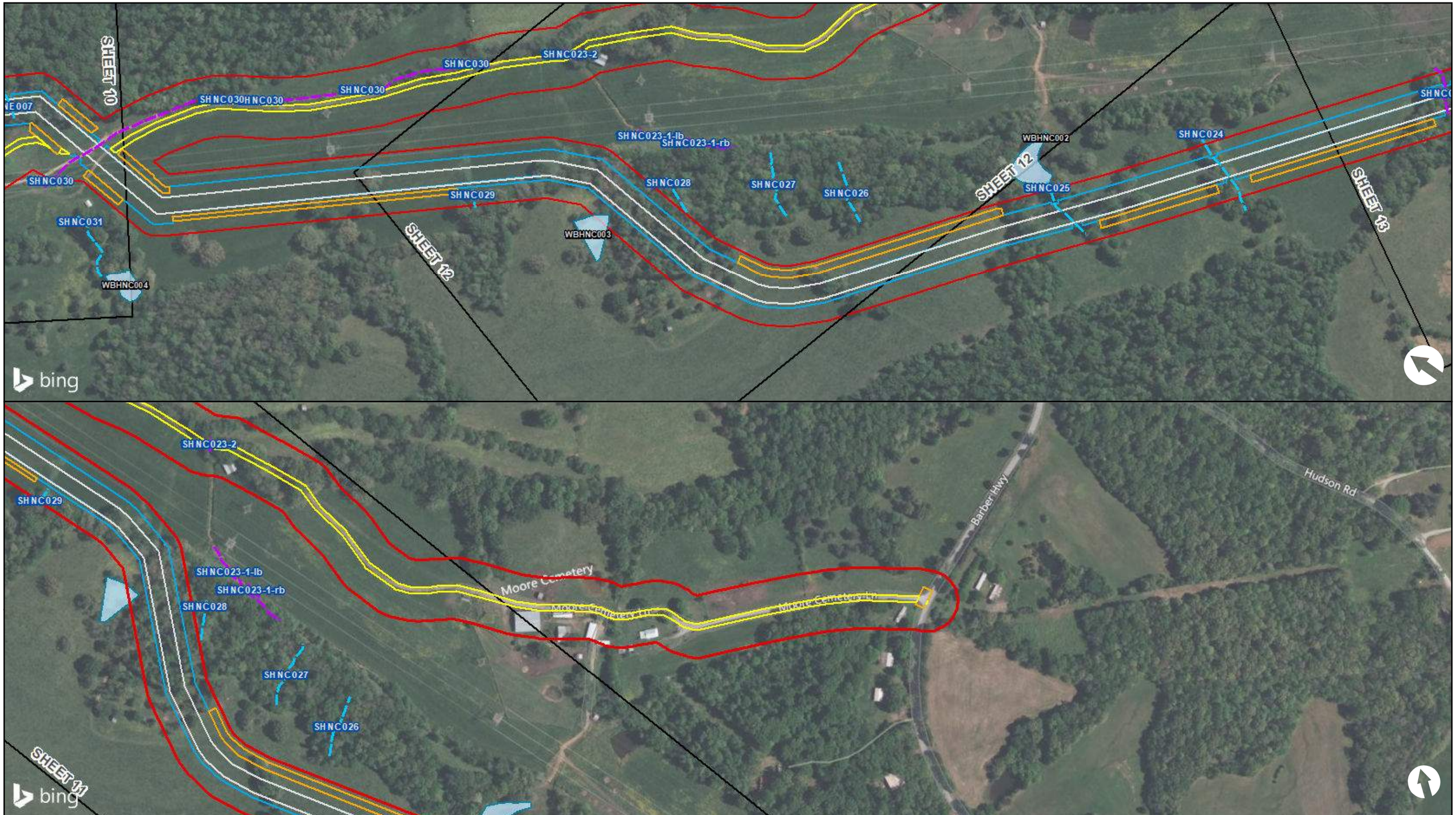

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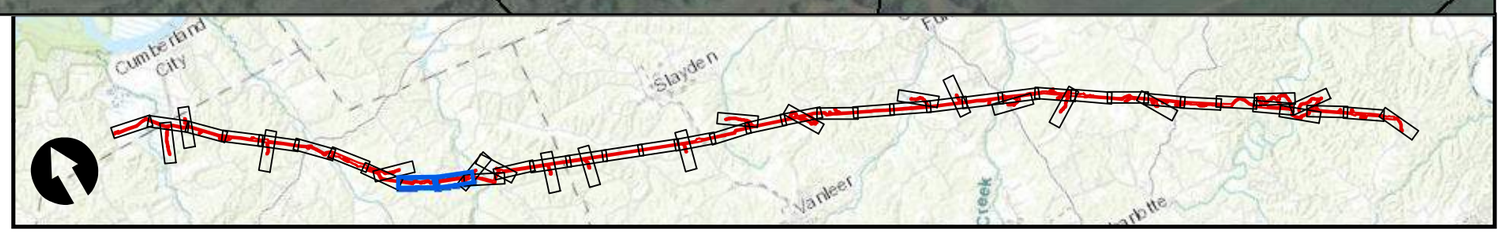
DATA SOURCE: Kinder Morgan Resource Report; Bing Hybrid Aerial Imagery

SHNC022
SHNC023
SHEET 11
WBHNC001
SHNC021
SHNC019
SHNE002
SHNC020
Herman Adams Rd
SHNE001
SHEET 14
bing

SHEET 13
SHNC016
SHNC017
SHNC015
SHEET 15
SHNC018-1-lb
SHNC018-1-rb
SHEET 16
SHNC018-2-rb
SHNC018-2-lb
bing



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DATA SOURCE: Kinder Morgan Resource Report; Bing Hybrid Aerial Imagery

SHNC007-5-rb
SHNC007-4-rb
SHNC007-5-rb
SHNC007-4-lb
SHNC007-5-lb
SHNC011
SHNC010-2
SHNC006
SHNC009
SHNC018-1-lb
SHNC018-1-rb
Ellis Mills Rd
Hayes Rd
SHEET 15
SHEET 16
SHEET 14
SHEET 18
SHNC007-1-rb
SHNC010-1
SHNC008
SHNC007-1-lb
Williamson Branch Rd
Ellis Mills Rd
Branch Rd
bing

SHNC018-2-lb
SHNC018-2-rb
SHNC018-1-rb
SHNC018-1-lb
Ellis Mills Rd
Yellow Creek
SHEET 17
SHEET 16
SHEET 14
bing

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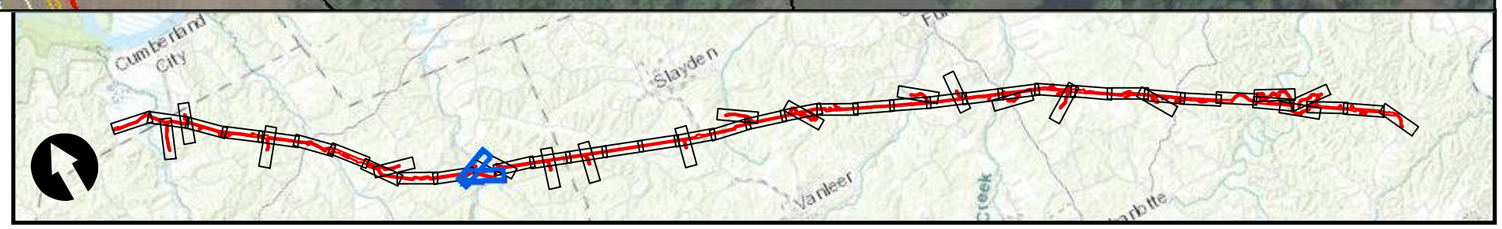

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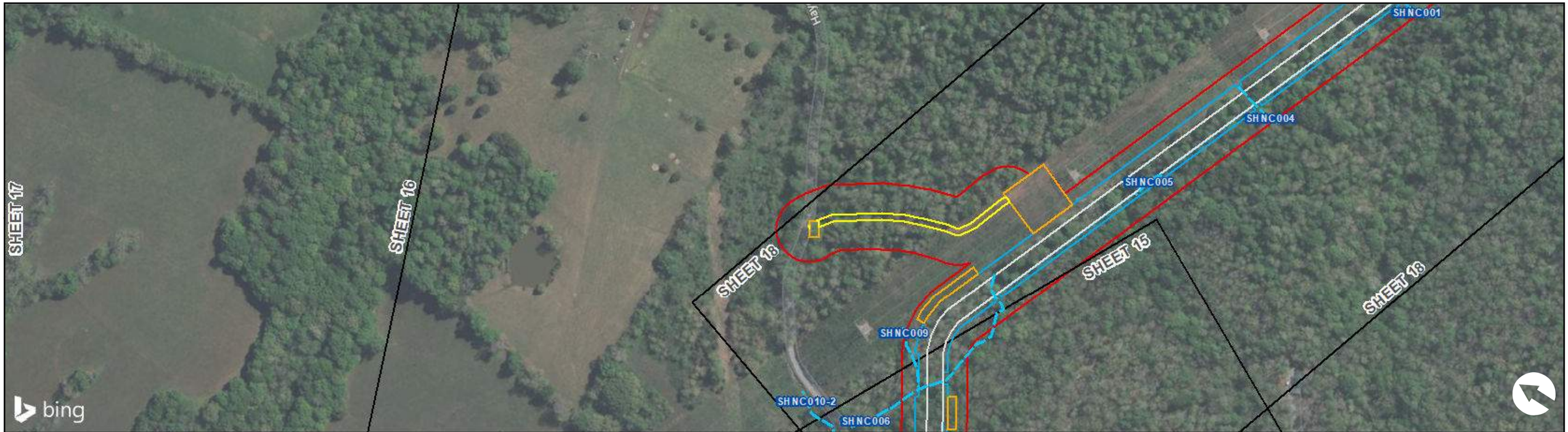

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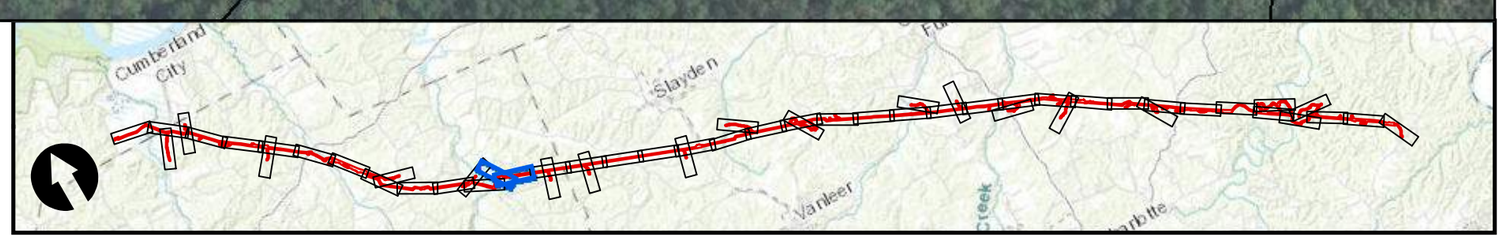

SHEET 18
SHEET 20
SHEET 20
SHEET 21
SH NC042
SH NW004a
SH NW004b
SH NW003a
SH NW002
bing

SHEET 19
SH NW003a
SH NW004a
SH NW004b
Norris Hollow Rd
bing

LEGEND

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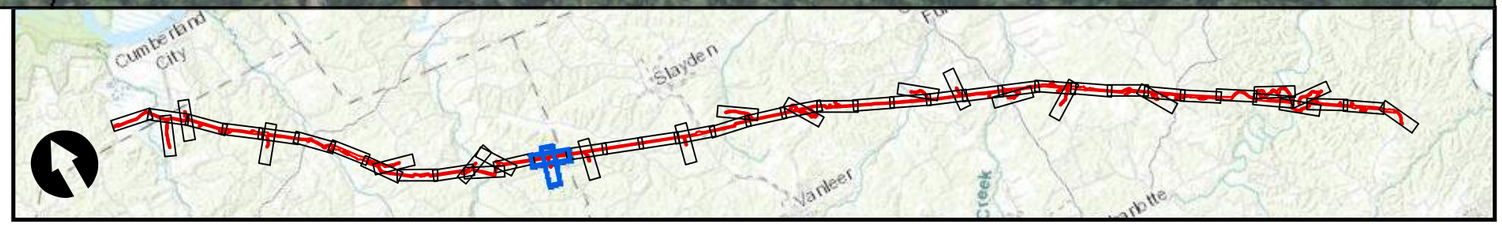

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SHEET 22
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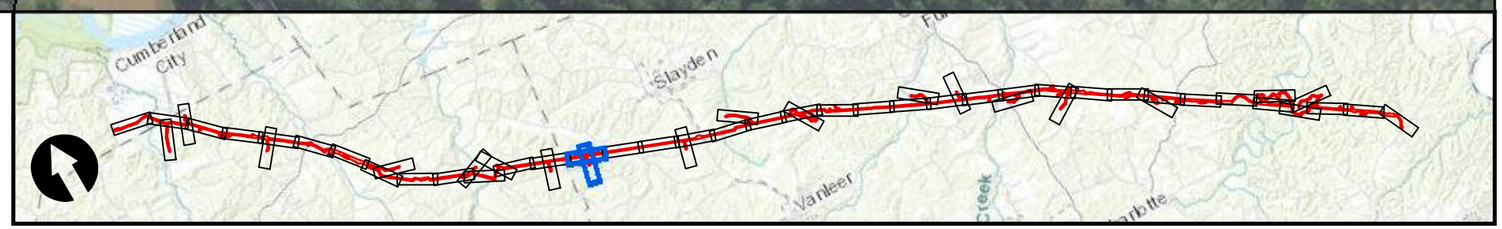
SHNW001
SDKR011
SDKR010
WBDKB010
bing

SHEET 21
SDKR010
Norris Hollow Rd
bing



LEGEND

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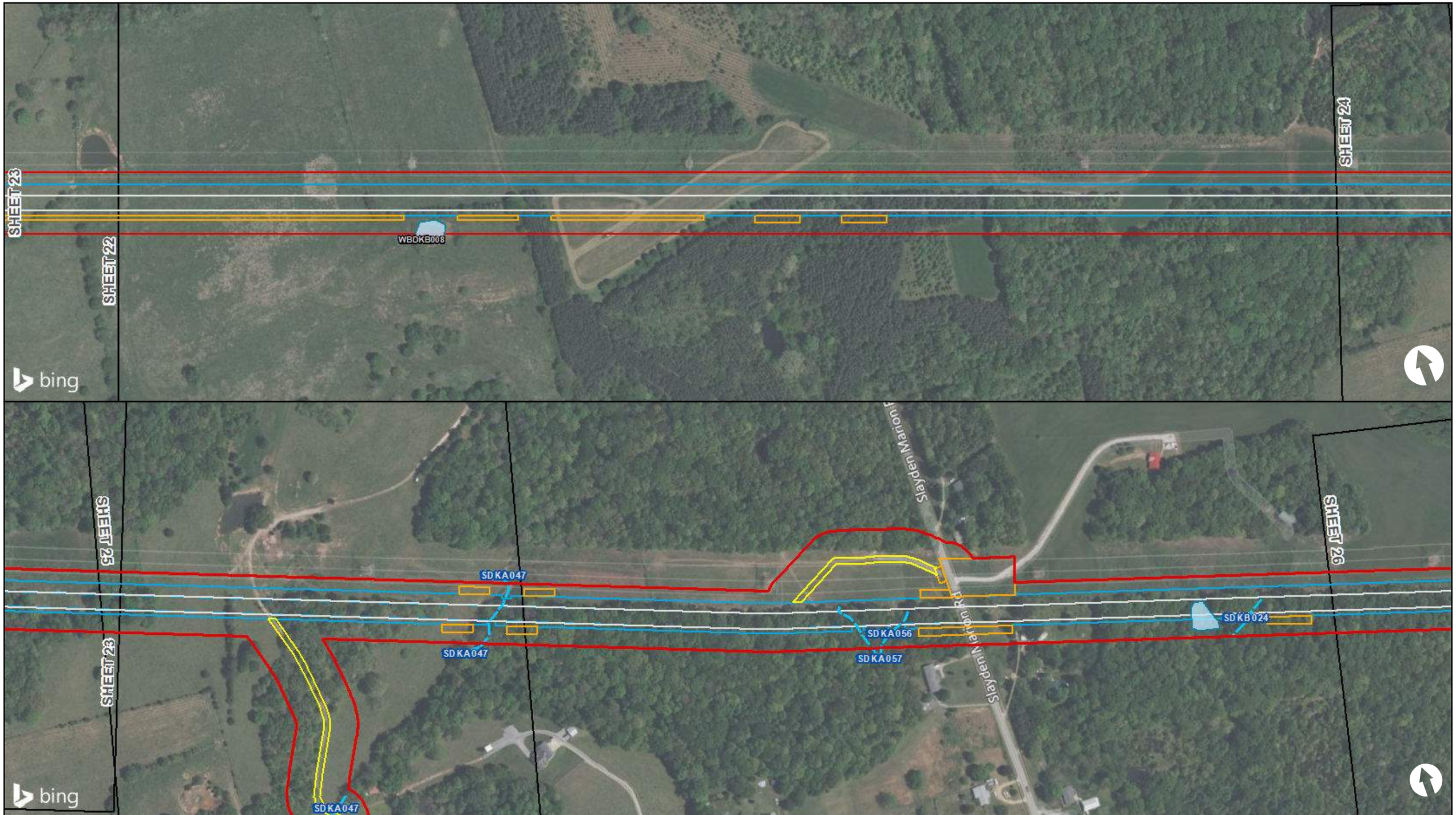

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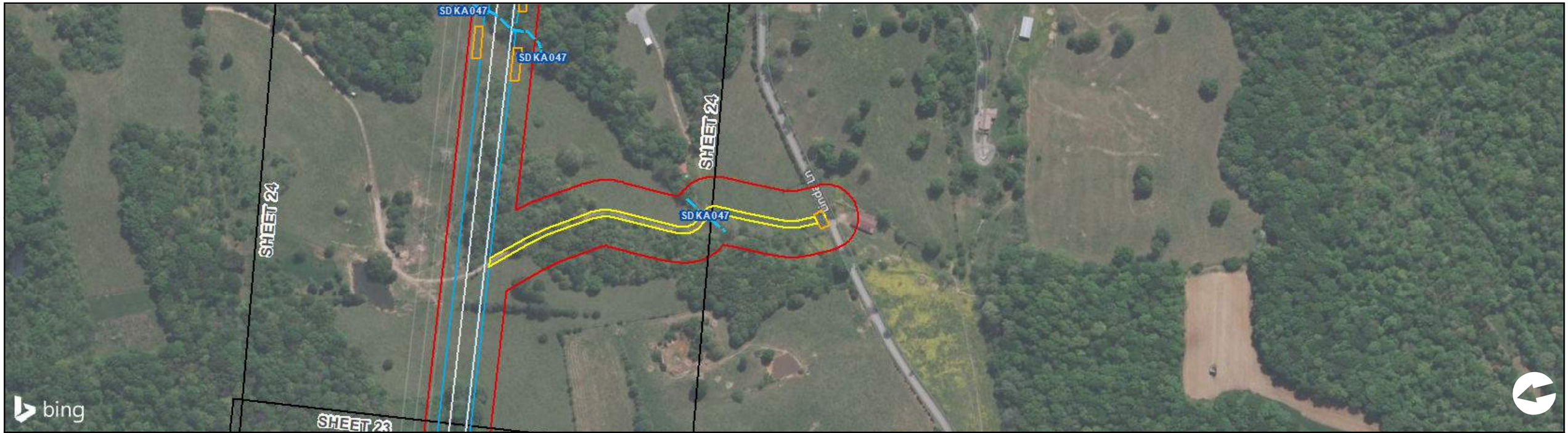

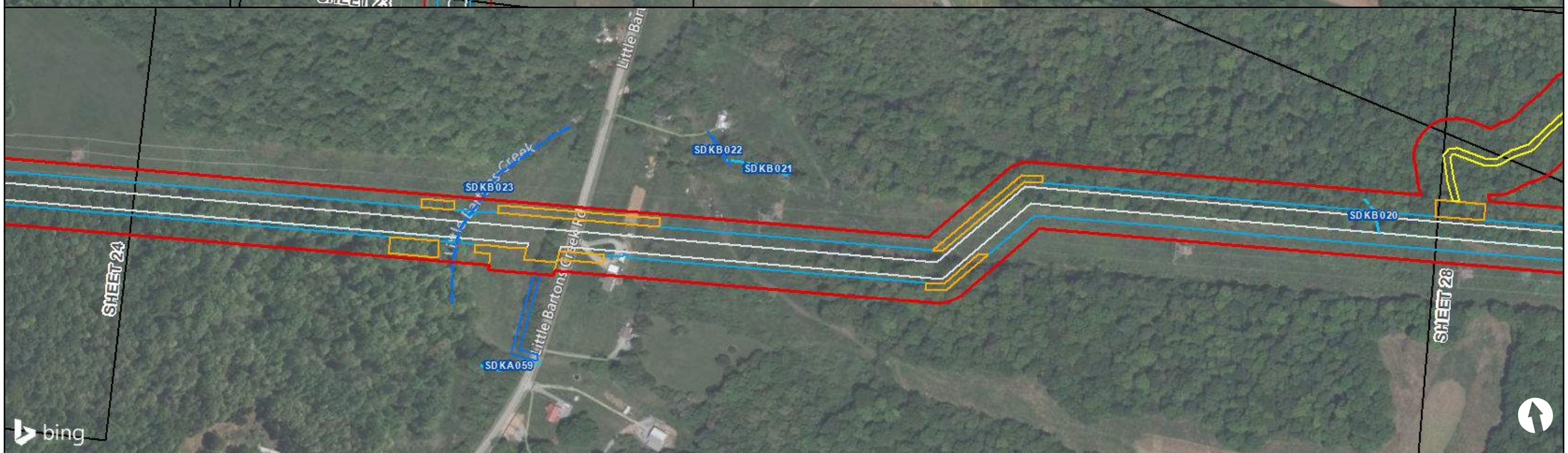

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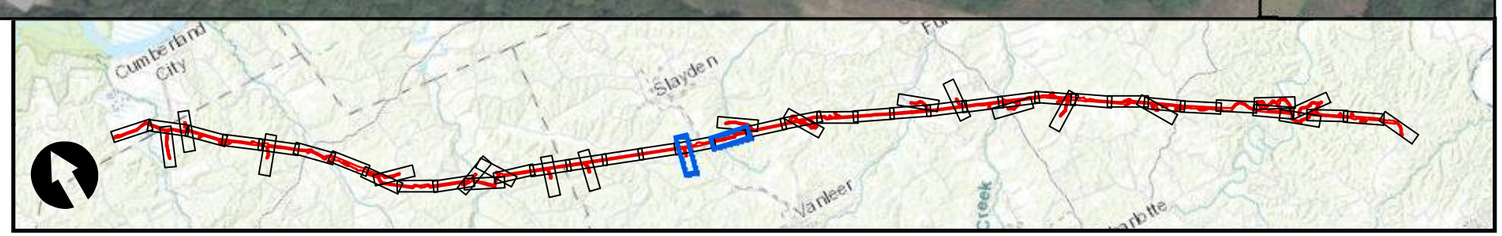

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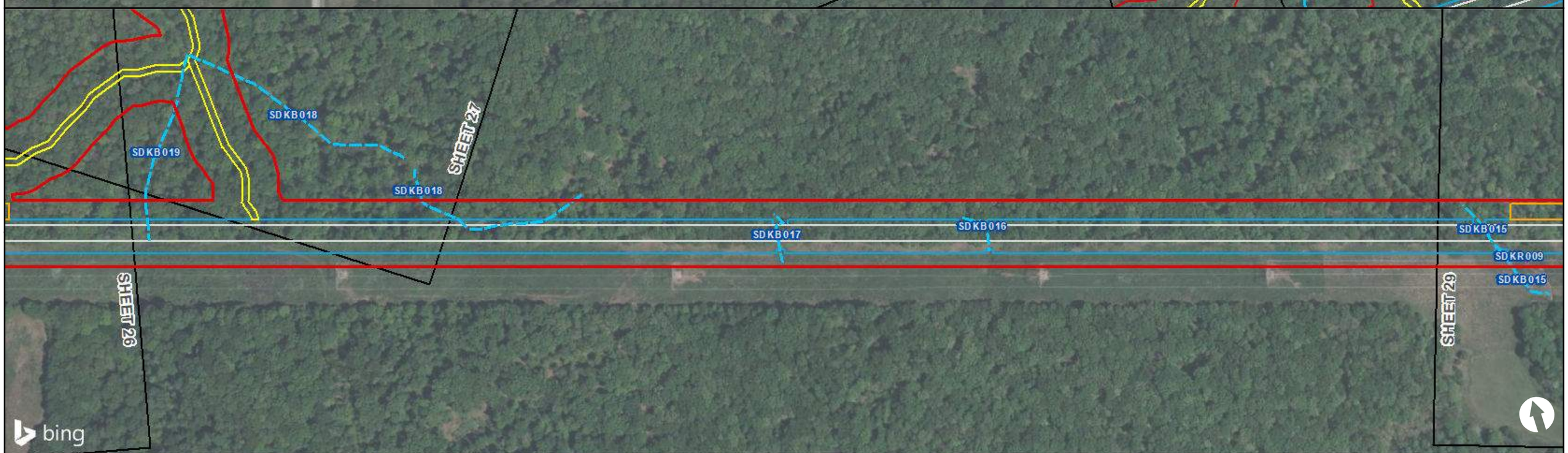

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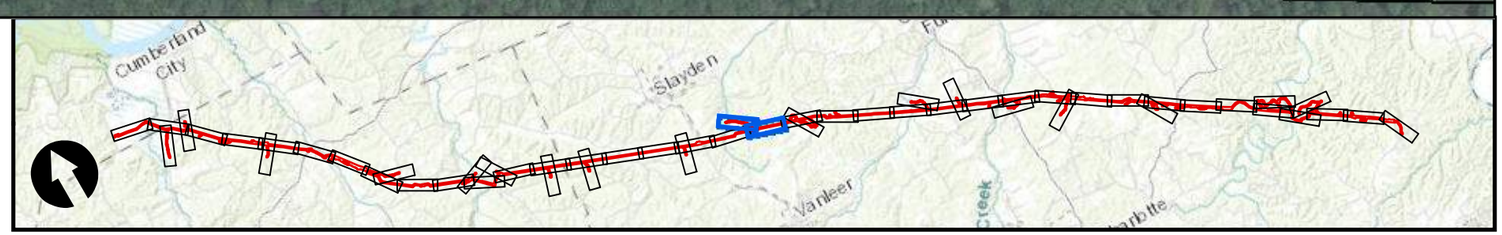

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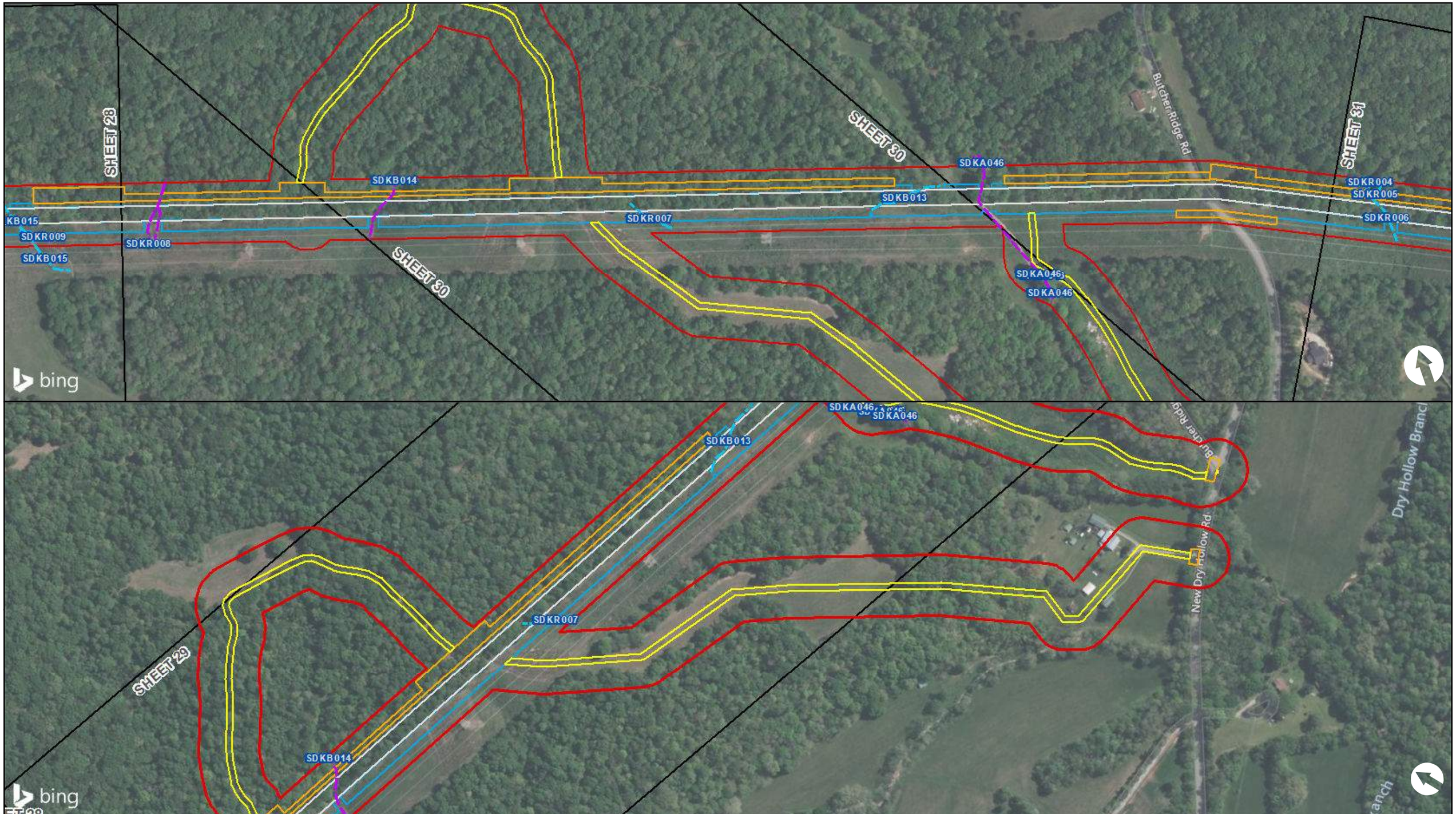

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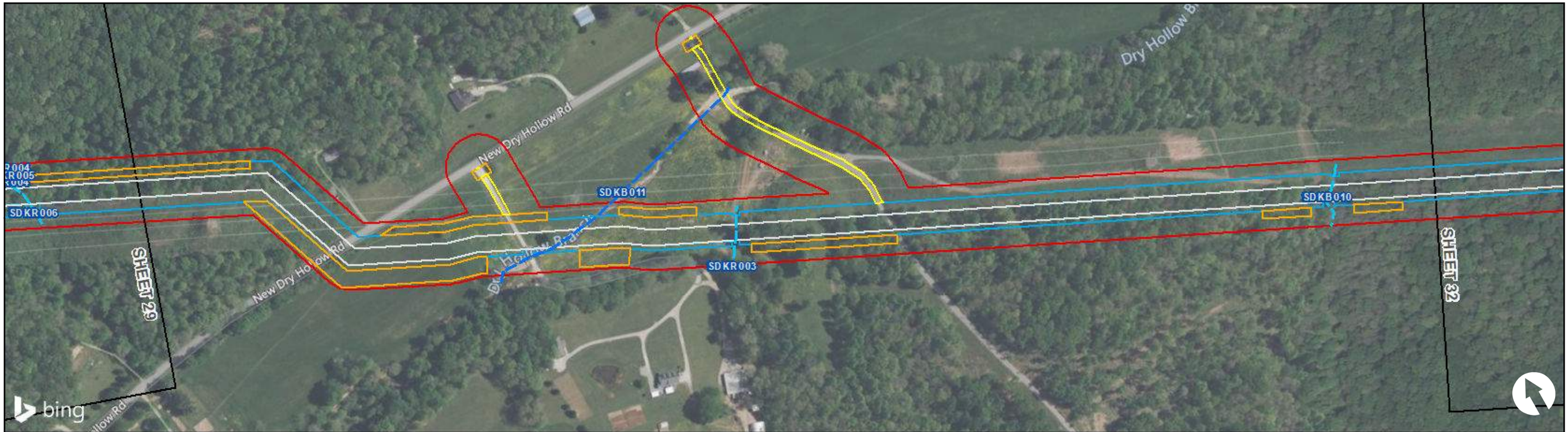

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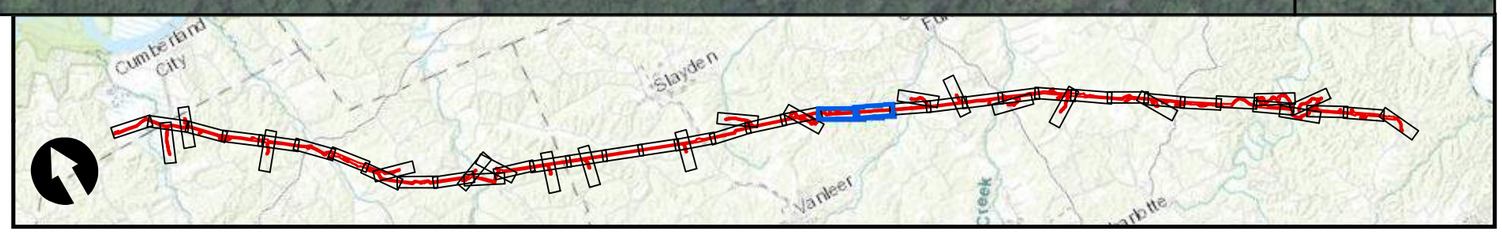

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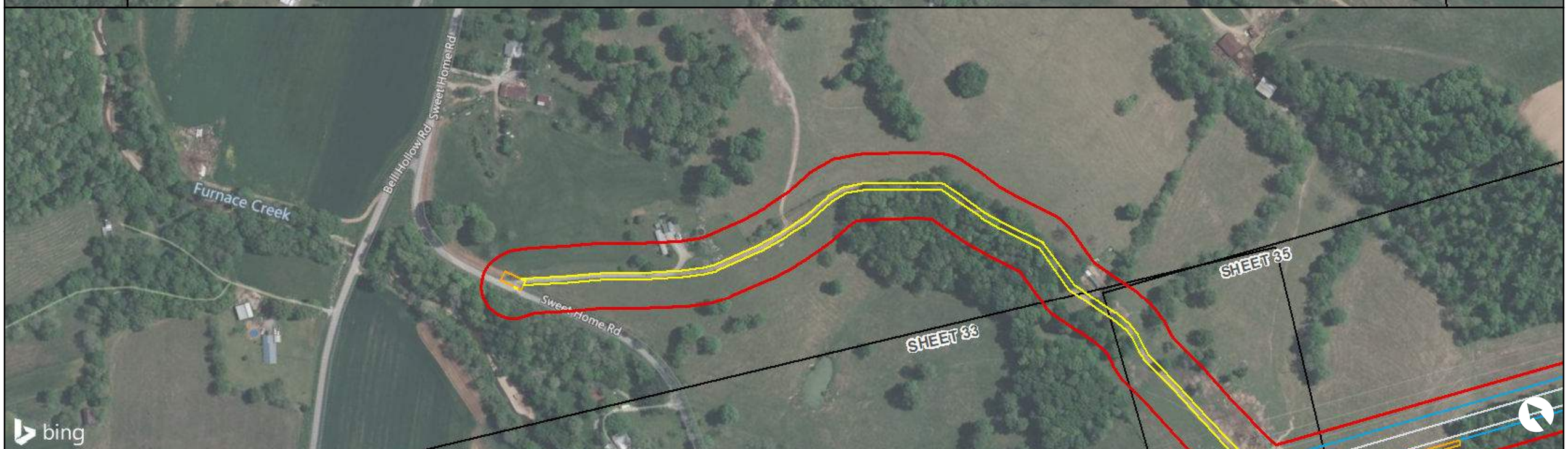

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  - Wet Weather Conveyance/Ephemeral
  - Stream/Intermittent
  - Stream/Perennial
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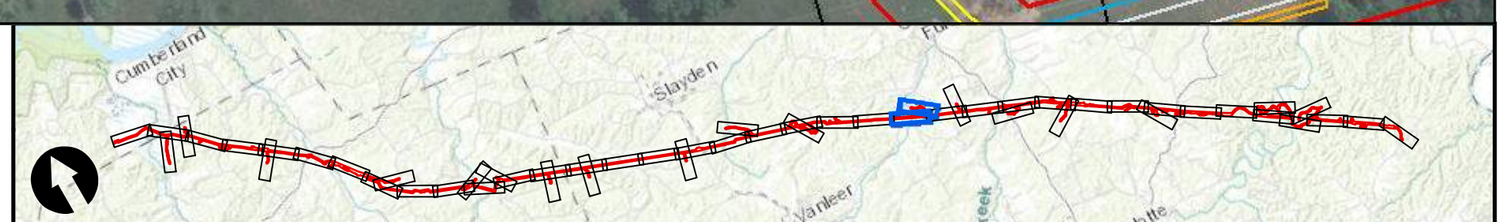
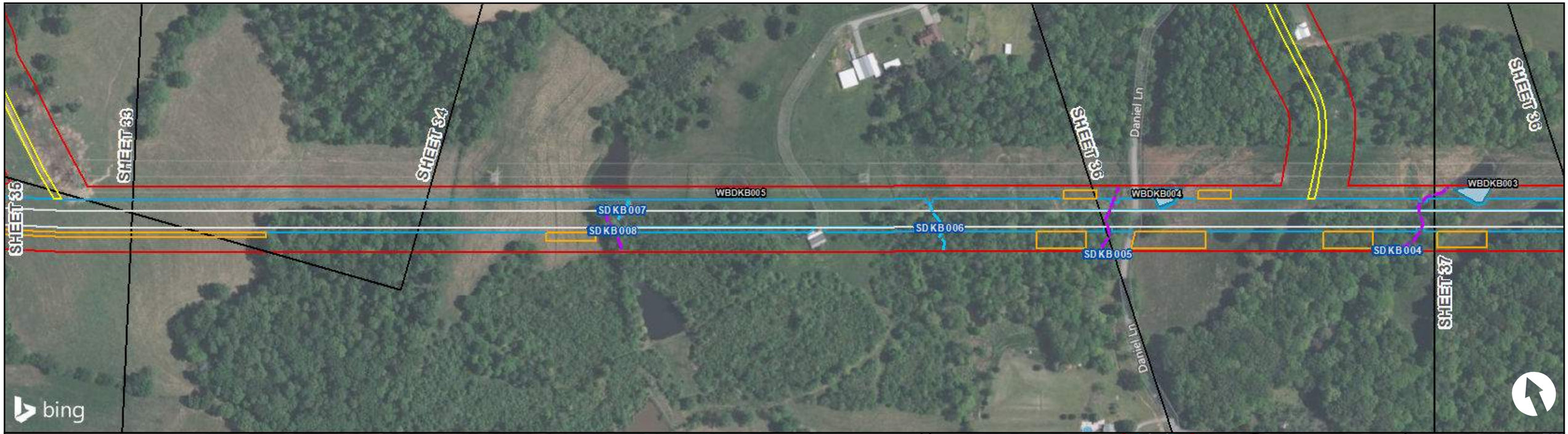
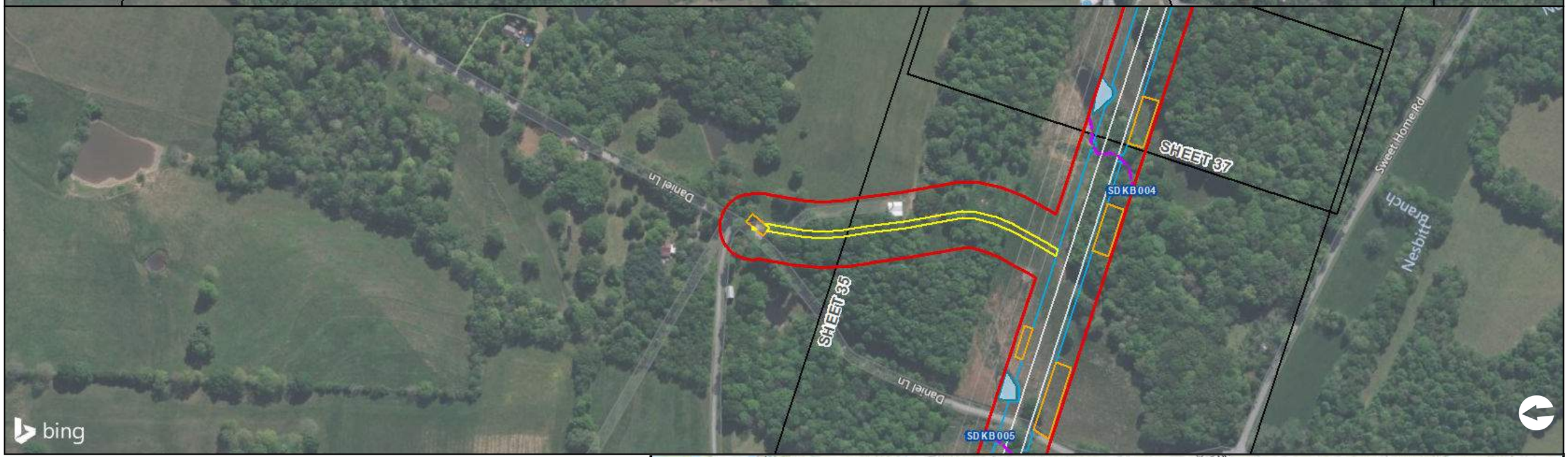
  - Pond
- Surveyed Wetlands
  - Palustrine Emergent
  - Palustrine Forested
- Contractor Yard
- MLV Site
- Cumberland Meter Station
- Proposed Pressure Regulation Station
- Permanent Easement
- Temporary Workspace
- Additional Temporary Workspace
- Access Road

0 Feet 300

DATA SOURCE: Kinder Morgan Resource Report; Bing Hybrid Aerial Imagery







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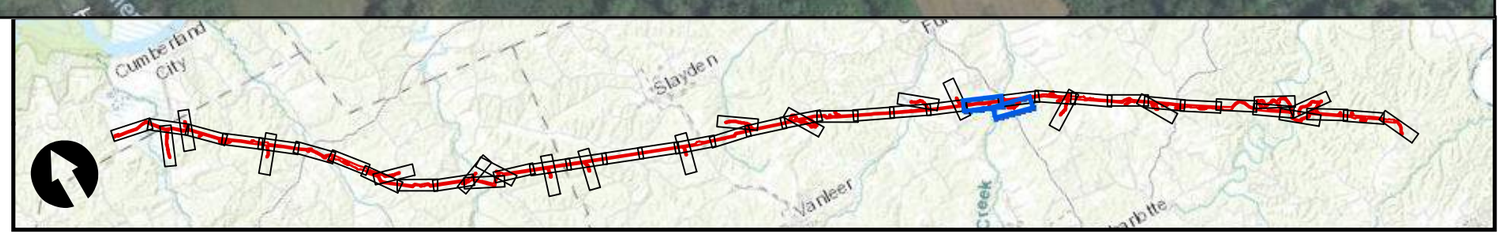
0 Feet 300

DATA SOURCE: Kinder Morgan Resource Report; Bing Hybrid Aerial Imagery

SHEET 35
SHEET 36
SHEET 37
SHEET 38
SHEET 39
WBDKA002
WBDKB001
WBDKB002
WBDK001
SDKB002_rb
SDKB002_lb
SDKB003
Old Highway 48
Harris Cemetery
Sweet Home Rd
Nesbitt Branch
Ira Rd
bing

SDKB001
SDKA042
SDKA043
SDKA044
Bartons Creek
Miller Branch
Ira Rd
Highway 48 N
SHEET 37
SHEET 39
bing



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0 Feet 300

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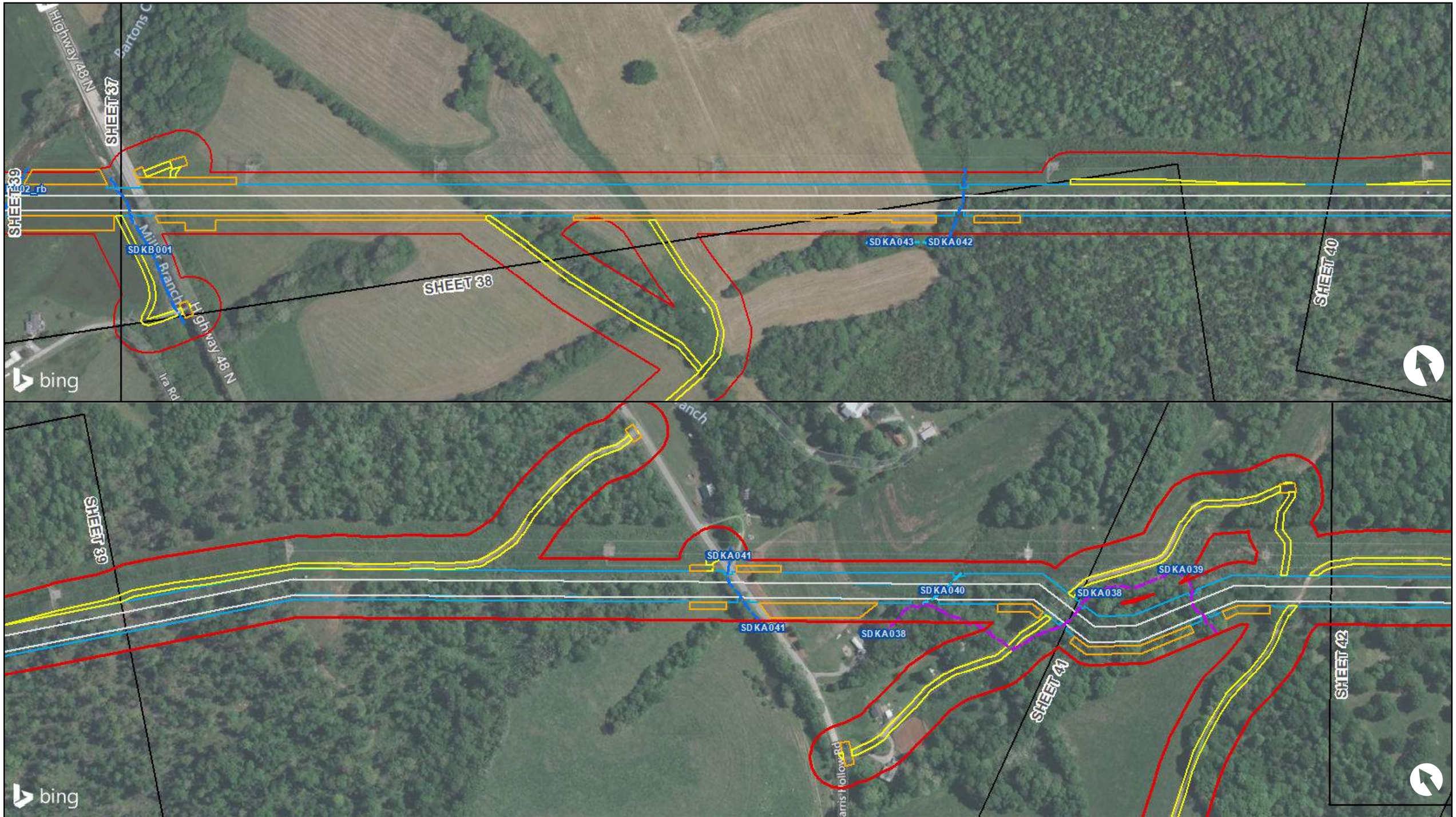

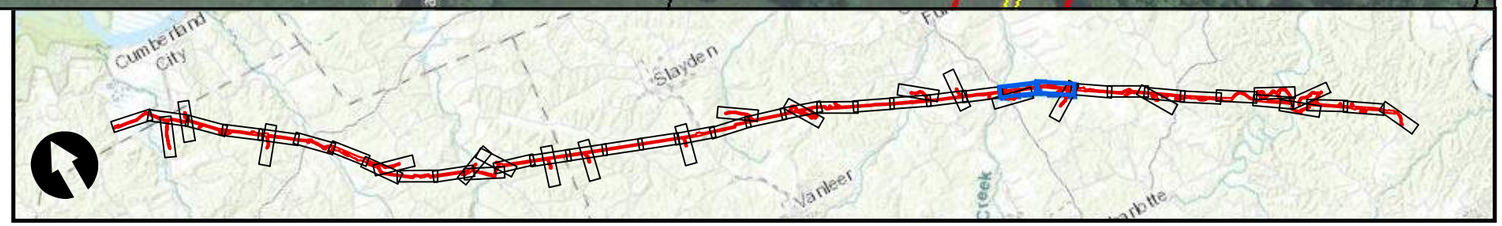

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0 Feet 300

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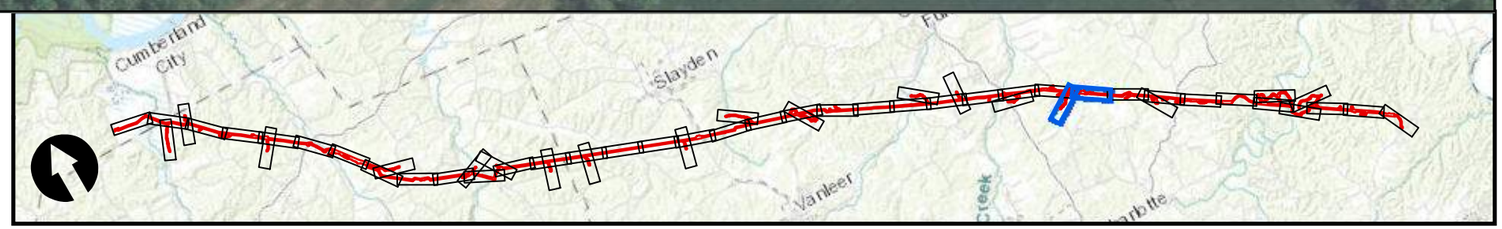
0 Feet 300



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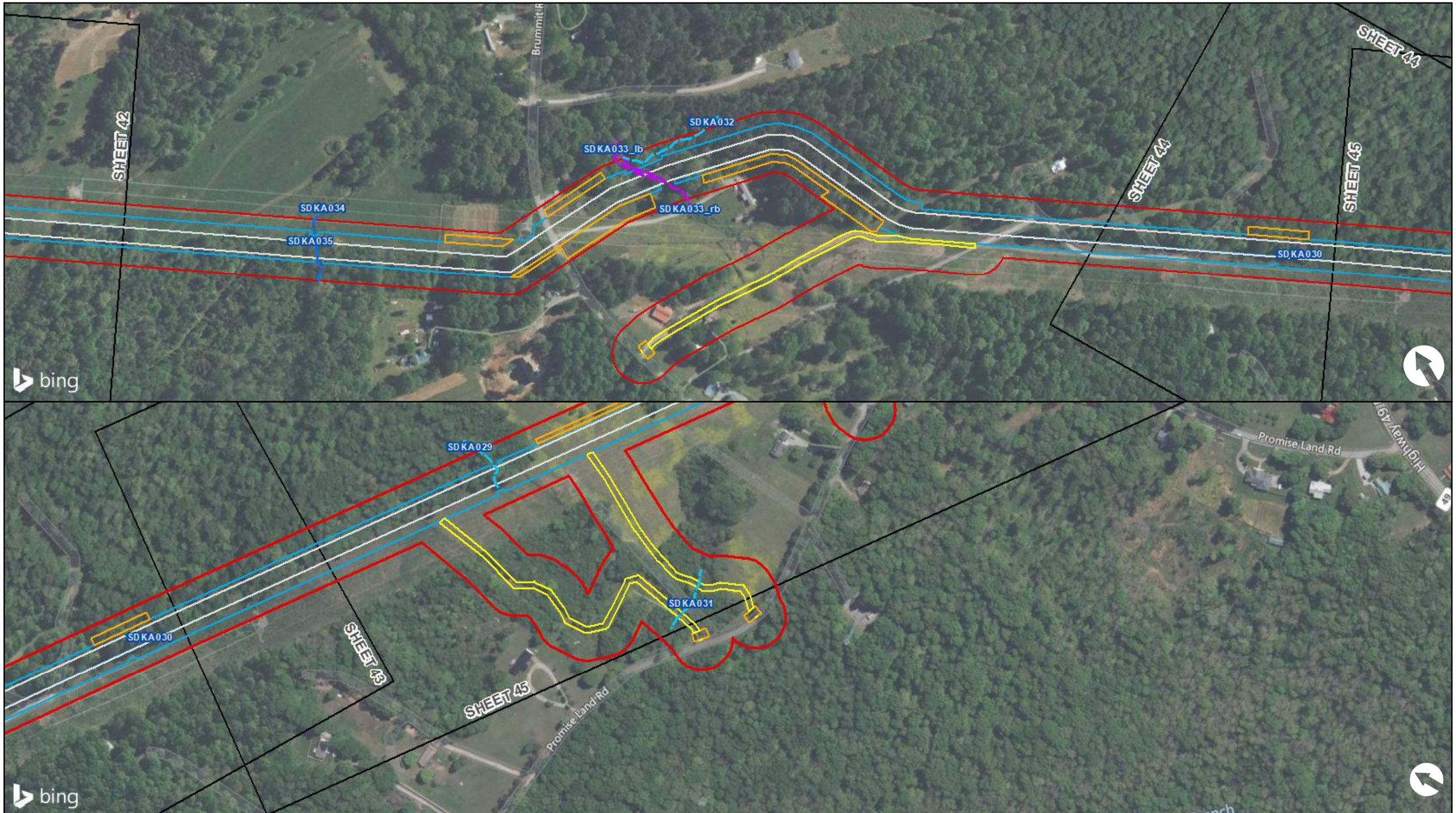

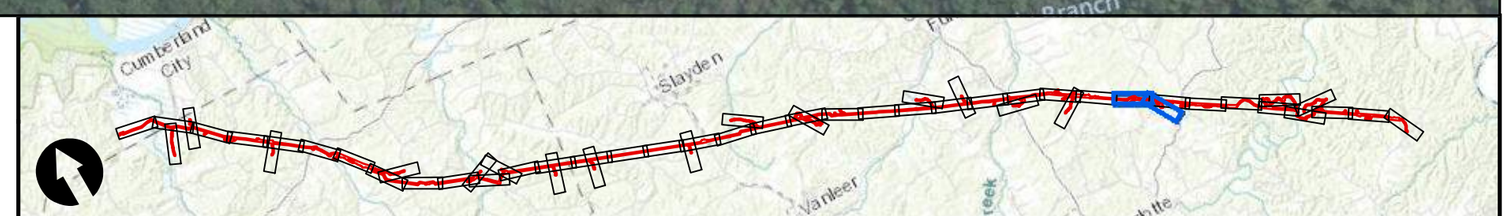

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0 Feet 300

DATA SOURCE: Kinder Morgan Resource Report; Bing Hybrid Aerial Imagery

SDKA029
SDKA028
SDKA028
SDKA020
SDKA031
SHEET 45
SHEET 43
SHEET 44
SHEET 46
Promise Land Rd
Highway 49E
49
bing

SDKA018
SDKA017
SDKA019
SHEET 47
SHEET 45
bing

LEGEND

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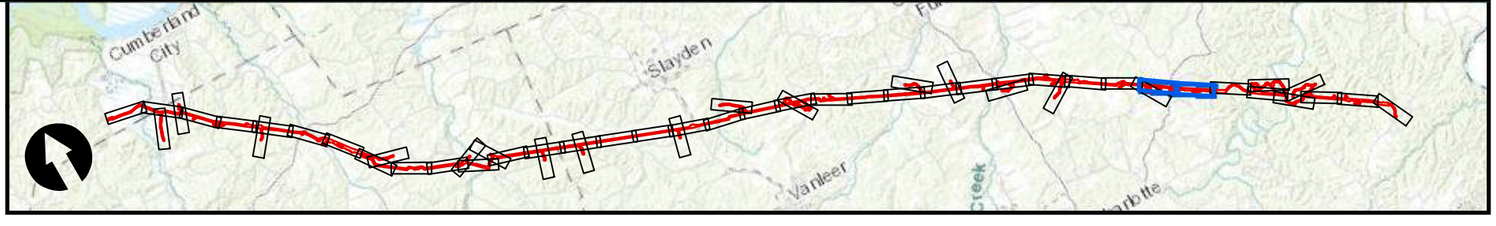

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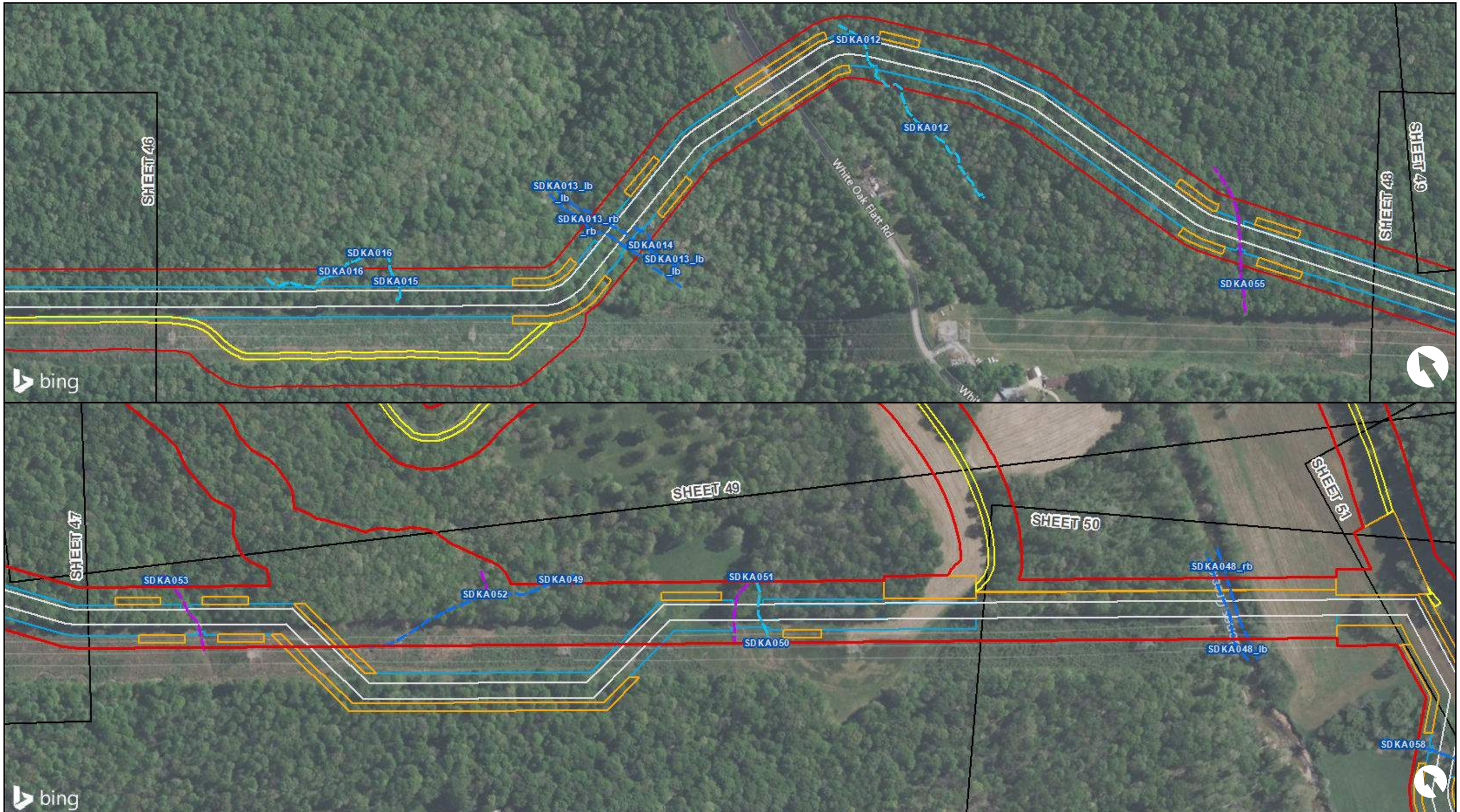

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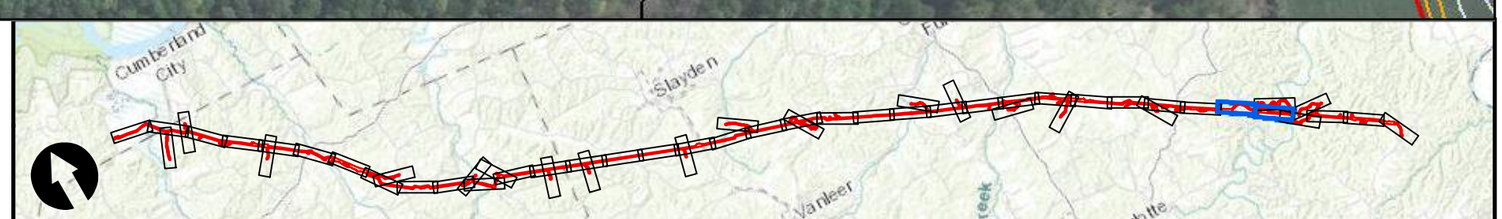

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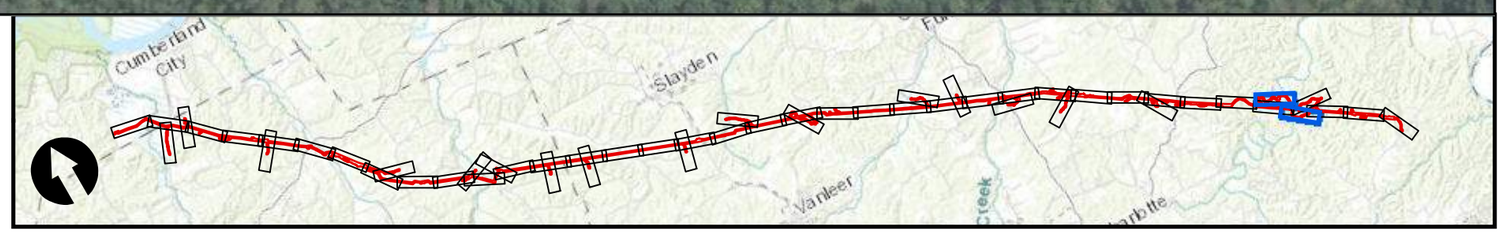
0 Feet 300



DATA SOURCE: Kinder Morgan Resource Report; Bing Hybrid Aerial Imagery

SHEET 49
SHEET 48
SHEET 50
SHEET 52
SDKA009
SDKA009
SDKA010
SDKA009
KA058
Nosegay Rd
bing

SHEET 51
SDKA008
SDKA007
SDKA006
SDKA006
SDKA005
SHEET 50
SHEET 53
SDKA004
Nosegay Rd
bing

LEGEND

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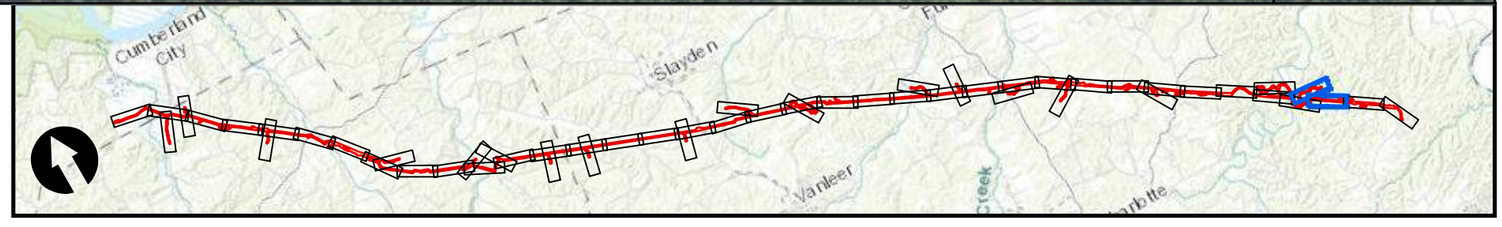

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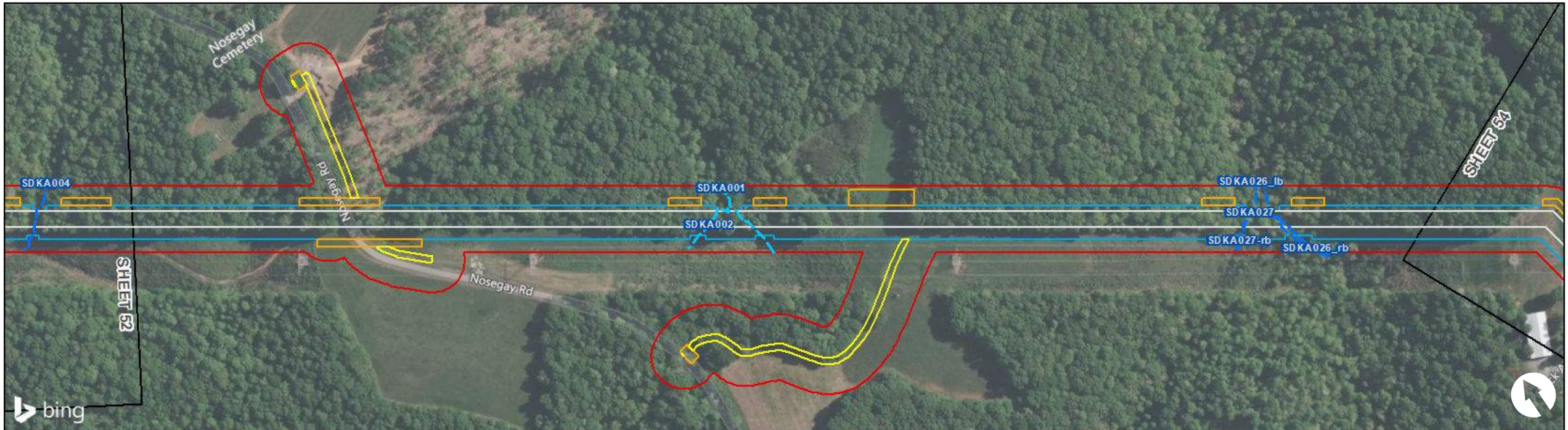

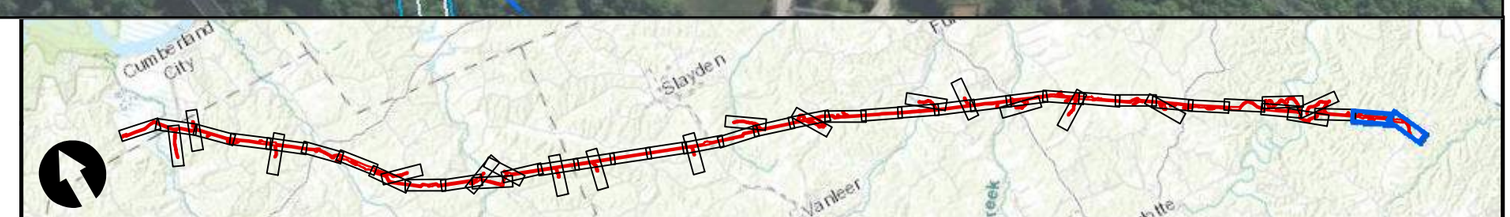

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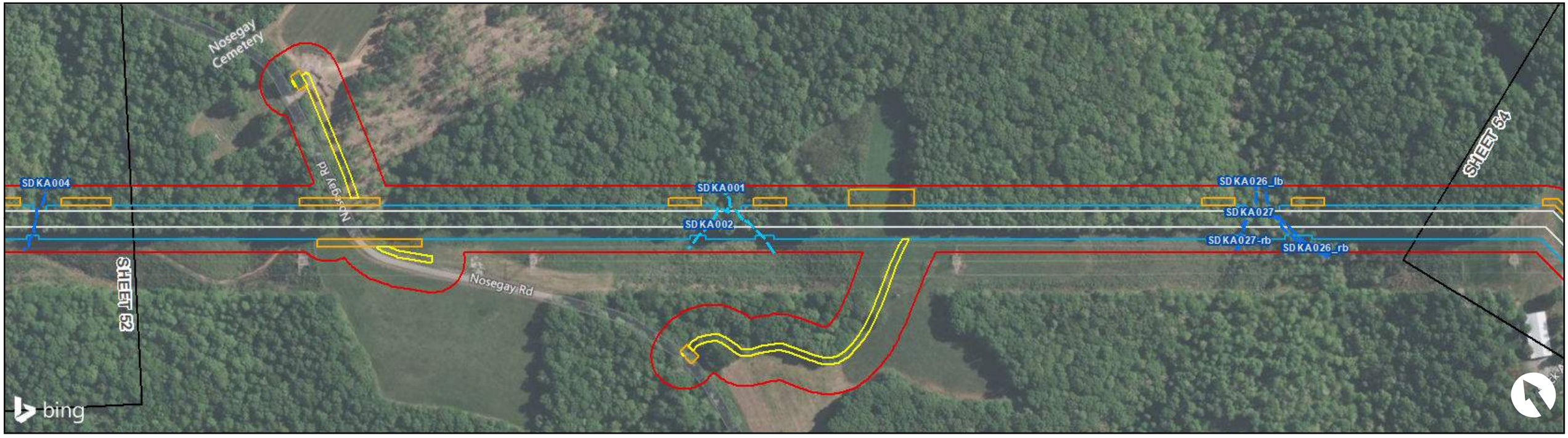

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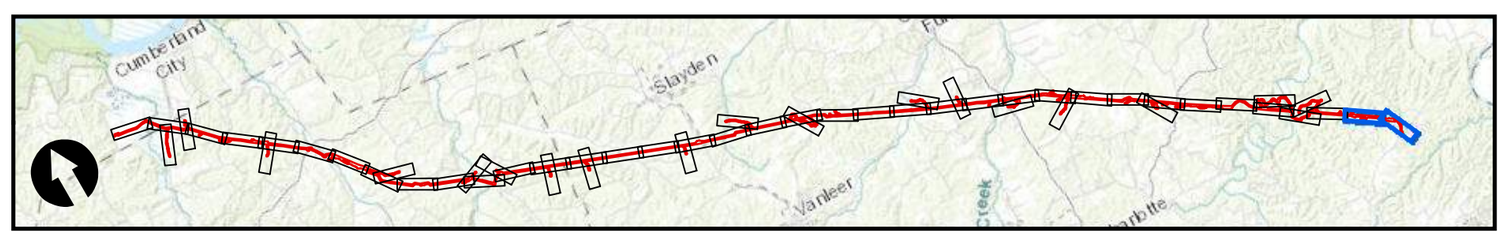

Appendix H – Air Pollutant Emissions Tables

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Pollutant	(Abbrev.)	ACC	ACK	ALF	BCT	BRF	CCC	CCT	CUF	GAF	GCC	JCC	JCT	KCT	KIF	LCC	LCT	MCT	MCC	PAF	SCC	SHF	Total
Particulate Matter	PM	100	56.3	67.8	10.9	74.3	136	3.59	343	183	15.8	80.3	20.6	18.4	182	22.9	35.2	20.1	140	772	151	651	3,084
Total PM<10 microns	TPM10	102	96.5	44.9	37.7	102	120	5.9	1520	259	29.9	83.1	28.8	30.3	380	26.2	58.1	29.1	203	992	159	641	4,949
Total PM<2.5 microns	TPM2.5	102	96	26.4	37.7	79.6	119	5.9	1410	197	29.9	83.1	28.8	30.3	319	26.1	58.1	29.1	198	819	152	401	4,248
Sulfur Dioxide	SO2	6.66	6.88	902	2.01	199	8.33	0.284	7410	1830	1.8	11	2.51	1.73	1330	116	3.6	1.12	12.5	2550	8.54	15100	29,504
Nitrogen Oxides	NOX	224	141	277	244	794	154	352	4300	1300	216	176	245	83	1160	14.6	167	54.9	243	4960	171	8230	23,507
Carbon Monoxide	CO	33.6	419	63.5	191	171	71.2	10.4	1140	826	46.8	54.2	101	115	430	22.4	271	41	96	504	226	1010	5,843
Volatile Organic Compnds	VOC	34.8	11.3	14.1	16.2	20.2	29.3	0.843	135	99.4	9.04	52.9	19.8	17.4	51.5	5.64	9.19	3.55	25.4	144	16.4	121	837
Sulfuric Acid	H2SO4	0.195	0.993	0.00376	0.151	30	0.0274	0.0229	1100	0.024	0.139	0.0466	0.0474	0.15	192	0.0305	0.262	0.105	1.88	357	0.0168	1.27	1,684
Ammonia	NH3	13.5	24.6	4.93		1.55	220		4.77	65.5		17.9	4.81		15.7	10.6			24.3	4.94	15.6	18.6	447
Carbon Dioxide	CO2	1320000	1360000	457000	399000	1600000	1650000	59700	11100000	6060000	357000	2070000	501000	299000	3850000	1120000	577000	222000	2480000	7190000	1690000	7990000	52,351,700
Methane	CH4	24.5	24.9	5.06	7.18	17.3	30.6	1.1	122	64	6.61	39	9.19	5.66	38.5	21.9	10.8	4.27	49.6	91.5	32.3	78.7	685
Nitrous Oxide	N2O	2.45	2.49	7.58	0.718	26.7	3.06	0.113	192	101	0.661	3.98	0.932	0.575	61.2	2.19	1.09	0.435	4.96	79.1	3.23	125	619
CO2 equivalent (GHGs)	CO2e	1330000	1360000	459000	399000	1600000	1650000	59700	11200000	6100000	357000	2070000	503000	299000	3870000	1120000	578000	222000	2480000	7220000	1690000	8030000	52,596,700
Mercury	Hg	1.7E-05	9.7E-06	6.0E-04	2.8E-06	2.6E-03	1.6E-05	6.4E-06	1.6E-02	2.1E-02	3.1E-06	1.7E-04	2.5E-04	2.1E-05	9.1E-03	8.3E-06	2.5E-05	1.7E-05	1.9E-05	1.0E-02	1.7E-05	1.6E-02	7.6E-02
Lead	Pb								1.13E-01														

Pollutant	(Abbrev.)	ACC	ACK	ACT	BCT	BRF	CCC	CCT	CUF	GAF	GCC	JCC	JCT	KCT	KIF	LCC	LCT	MCT	MCC	PAF	SCC	SHF	Totals
Particulate Matter	PM	137	55.5	0.227	9.31	75.5	59.4	0.185	278	163	13.2	82	17.3	10.9	264	23.8	19	5.07	91.7	406	121	540	2,372
Total PM<10 microns	TPM10	140	94.9	0.328	32.4	115	123	0.296	1310	224	25	84.8	22.1	18	469	27.4	31.3	7.3	129	629	131	538	4,152
Total PM<2.5 microns	TPM2.5	140	94.3	0.328	32.4	91.3	117	0.296	1230	170	25	84.8	22.1	18	377	27.2	31.3	7.3	126	572	125	342	3,633
Sulfur Dioxide	SO2	11.4	6.73	0.0145	1.73	308	8.34	0.0136	7210	1730	1.5	10.6	3.25	1.01	1920	6.16	2.31	0.47	8.57	2130	7.21	16300	29,667
Nitrogen Oxides	NOX	223	144	7.51	203	741	156	11.2	3930	1350	179	174	65.8	48.5	1260	108	84.2	15	174	4410	143	8030	21,457
Carbon Monoxide	CO	19.5	176	0.393	164	161	59	0.502	1030	698	56.7	46.9	62.8	40.7	493	24.7	146	8.07	101	372	192	996	4,848
Volatile Organic Compnds	VOC	49.9	11.1	0.417	13.8	19.1	29	0.0422	122	85.3	7.52	54	16.2	10.3	58.9	24.6	4.97	0.975	26.5	117	11.9	119	783
Sulfuric Acid	H2SO4	0.162	0.972	0.00117	0.129	43.2	0.0213	0.0011	966	0.417	0.116	0.0532	0.0375	0.0862	215	0.0488	0.158	0.0379	1.19	253	0.0252	1.54	1,482
Ammonia	NH3	2.62	32.8			1.32	91.4		4.1	49.4		2.3	1.02		16.3	15.6			36	3.12	48.5	15.5	320
Carbon Dioxide	CO2	2260000	1330000	2530	342000	1510000	1650000	3150	10000000	4990000	297000	2110000	412000	177000	4350000	1220000	306000	55500	1700000	5750000	1430000	7650000	47,545,180
Methane	CH4	41.6	24.4	0.0722	6.12	16.7	30.4	0.055	108	52.9	5.51	39.6	7.65	3.35	44.8	22.9	5.84	1.09	31.5	80.4	27.8	77.9	629
Nitrous Oxide	N2O	4.16	2.44	0.0122	0.612	25.9	3.04	0.00602	169	81.6	0.551	3.96	0.788	0.34	71	2.29	0.595	0.117	3.15	55.1	2.78	124	551
CO2 equivalent (GHGs)	CO2e	2270000	1330000	2530	342000	1520000	1650000	3160	10100000	5020000	298000	2120000	415000	177000	4370000	1220000	306000	55500	1700000	5780000	1430000	7690000	47,799,190
Mercury	Hg	2.2E-05	9.4E-06	9.1E-06	2.5E-06	2.2E-03	1.6E-05	9.6E-07	7.4E-03	2.4E-07	2.4E-06	2.6E-05	1.7E-04	1.0E-05	1.0E-02	8.6E-06	2.3E-05	1.5E-05	1.3E-05	9.6E-03	1.4E-05	1.1E-02	4.1E-02
Lead	Pb								8.76E-02														

Pollutant	(Abbrev.)	ACC	ACK	ACT	BCT	BRF	CCC	CCT	CUF	GAF	GCC	JCC	JCT	KCT	KIF	LCC	LCT	MCT	MCC	PAF	SCC	SHF	Totals
Particulate Matter	PM	88.6	54.8	0.00328	8.62	56.6	66	0.253	335	130	12.9	83.9	23.3	10.4	109	25.6	9.11	1.94	128	223	167	264	1,798
Total PM<10 microns	TPM10	90.4	92.3	0.00553	29.9	69.3	139	0.41	1410	157	24.4	86.8	29.1	17.2	137	29.4	15	2.74	182	370	179	257	3,318
Total PM<2.5 microns	TPM2.5	90.4	91.7	0.00553	23.9	52	132	0.41	1300	116	24.4	86.8	29.1	17.2	103	29.3	15	2.74	176	358	172	167	2,987
Sulfur Dioxide	SO2	7.4	6.59	0.000381	1.15	229	9.43	0.0197	7180	1040	1.47	10.8	2.56	0.918	873	6.86	1.17	0.418	12	395	9.75	9020	18,808
Nitrogen Oxides	NOX	230	141	0.197	132	436	181	11.3	3920	946	171	169	94.5	40.3	696	121	36.1	6.62	237	1530	193	4600	13,892
Carbon Monoxide	CO	41.7	170	0.0119	110	82.1	52.8	0.705	1080	402	77.5	22.1	62.3	35.3	222	11	69.8	2.29	68	114	220	630	3,474
Volatile Organic Compnds	VOC	30.5	10.8	0.367	20.8	9.54	33.2	0.0584	129	50.3	7.36	54.3	18.5	9.88	26.6	25.1	2.39	0.432	26.8	66.9	18.3	75.3	616
Sulfuric Acid	H2SO4	0.0418	0.944	3.07E-05	0.086	22.1	0.0202	0.00158	1010	0.537	0.114	0.041	0.0517	0.0744	35	0.0226	0.0815	0.0336	1.67	111	0.00686	0.778	1,183
Ammonia	NH3	2.05	23.5			0.778	84.4		3.16	22.7		0.875	1.13		6.36	27.8			48.5	0.67	29.8	11.2	263
Carbon Dioxide	CO2	1470000	1300000	48.2	228000	755000	1870000	3300	1E+07	2860000	291000	2140000	515000	169000	1960000	1360000	147000	19700	2370000	3320000	1930000	4710000	37,818,048
Methane	CH4	27.2	23.7	0.00202	4.09	9.11	34.8	0.0763	112	30.4	5.4	40.5	9.39	3.18	20.3	26.3	2.81	0.432	44.1	59.8	37.3	49.3	540
Nitrous Oxide	N2O	2.72	2.37	0.000404	0.409	13.6	3.48	0.00814	177	44.8	0.54	4.05	0.948	0.32	32.1	2.63	0.286	0.0545	4.41	14.4	3.73	78.2	386
CO2 equivalent (GHGs)	CO2e	1470000	1310000	48.4	229000	759000	1870000	3310	1E+07	2870000	292000	2140000	516000	169000	1970000	1360000	147000	19800	2390000	3330000	1930000	4730000	37,905,158
Mercury	Hg	1.7E-05	8.6E-06	3.7E-07	2.6E-06	9.7E-04	1.8E-05	9.5E-07	1.0E-04	3.5E-03	2.3E-06	2.6E-05	5.5E-05	4.6E-06	4.8E-03	9.6E-06	1.2E-05	2.0E-05	1.6E-05	1.6E-03	1.9E-05	4.2E-03	1.5E-02
Lead	Pb								1.01E-01														

Table 3.7-3 - CUF Coal Retirement/Replacement EIS - Operational Air Emissions Comparisons - Only Direct Impact TVA Facilities

Pollutant	(Abbrev.)	CUF 3-Year Avg. Annual Emissions (2018-2020) (tons/yr)	Johnsonville 3-Year Avg. Annual Emissions (2018-2020) (tons/yr)	Gleason 3-Year Avg. Annual Emissions (2018-2020) (tons/yr)	Proposed CCs at CUF - Alternative A Emissions (tons/yr)	Proposed CTs at Johnsonville - Alternative B Emissions (tons/yr)	Proposed CTs at Gleason - Alternative B Emissions (tons/yr)	Net Change CUF Emissions - Alternative A (tons/yr)	Net Change Johnsonville Emissions - Alternative B (tons/yr) (1)	Net Change Gleason Emissions - Alternative B (tons/yr) (1)	Net Change Emissions - Alternative C - Solar/Battery Storage (tons/yr)
Particulate Matter/Total Suspended Particulate (Filterable only)	PM/TSP	318.7	20.4	14.0	95.7	7.5	5.6	-223.0	7.5	5.6	-318.7
Total PM<10 microns (Filterable+Condensible)	PM_{10}	1,413.3	26.7	26.4	154.5	30.0	22.5	-1,258.8	30.0	22.5	-1,413.3
Total PM<2.5 microns (Filterable+Condensible)	$PM_{2.5}$	1,313.3	26.7	26.4	154.5	30.0	22.5	-1,158.8	30.0	22.5	-1,313.3
Sulfur Dioxide	SO_2	7,266.7	2.8	1.6	13.8	2.4	1.8	-7,252.9	2.4	1.8	-7,266.7
Nitrogen Oxides	NOx	4,050.0	135.1	188.7	185.6	131.2	98.5	-3,864.4	131.2	98.5	-4,050.0
Carbon Monoxide	CO	1,083.3	75.4	60.3	133.2	80.1	60.2	-950.1	80.1	60.2	-1,083.3
Volatile Organic Compounds	VOC	128.7	18.2	8.0	60.2	9.7	7.3	-68.5	9.7	7.3	-128.7
Sulfuric Acid	H_2SO_4	1,025.3	0.0	0.1	0.0	0.0	0.0	-1,025.3	0.0	0.0	-1,025.3
Ammonia	NH_3	4.0	2.3	0.0	154.3	0.0	0.0	150.3	0.0	0.0	-4.0
Carbon Dioxide	CO_2	10,500,000.0	476,000.0	315,000.0	2,760,529.8	474,460.7	355,990.4	-7,739,470.2	-4,775,539.3	-4,894,009.6	-10,500,000.0
Methane	CH_4	114.0	8.7	5.8	195.5	34.0	25.5	81.5	-23.0	-31.5	-114.0
Nitrous Oxide	N_2O	179.3	0.9	0.6	68.1	11.9	8.9	-111.2	-77.8	-80.8	-179.3
CO_2 equivalent (GHGs)	CO_2-e	10,566,666.7	478,000.0	315,666.7	2,785,716.4	478,841.3	359,276.2	-7,780,950.3	-4,804,492.0	-4,924,057.1	-10,566,666.7
Mercury	Hg	7.8E-03	1.6E-04	2.6E-06	No Data	No Data	No Data	-7.8E-03	-1.6E-04	-2.6E-06	-7.8E-03
Lead	Pb	1.0E-01	No Data	No Data	No Data	No Data	No Data	-1.0E-01	No Data	No Data	-1.0E-01

(1) = The Net Change in GHG operational emissions for Alternative B accounts for GHG emissions reductions from CUF coal retirement, due to GHG emissions having global impact, and those reductions are considered split evenly between Johnsonville and Gleason. Criteria/HAP pollutant emissions reductions from CUF coal retirement only have a more local region of influence and are not included in Alternative B Net Change in operational emissions.

Additional hazardous air pollutants are emitted but in negligible quantities, except for hydrogen fluoride (HF) and hydrogen chloride (HCl). HF and HCl emissions from coal burning would be eliminated with the switch to natural gas combustion turbines.

NA = Not Applicable

Table 3.7-4 - CUF Coal Retirement/Replacement EIS - Net Social Benefit from Operational Emissions Reductions for Alternatives A, B, and C - Only Direct Impact TVA Facilities (2027) - Biden Administration SCC Rates

GHG Pollutant	(Abbrev.)	Nominal SCC Rate ($/mt) (2027)	Nominal SCC Rate ($/ton) (2027)	Net SCC Benefit - Alternative A (2027, Dollars)	Net SCC Benefit - Alternative B - Johnsonville (2027, Dollars)	Net SCC Benefit - Alternative B - Gleason (2027, Dollars)	Net SCC Benefit - Alternative B - Total (2027, Dollars)	Net SCC Benefit - Alternative C (2027, Dollars)
Carbon Dioxide	CO2	$ 68	$ 61	**$ (475,973,587)**	**$ (293,693,305)**	**$ (300,979,166)**	**$ (594,672,470)**	**$ (645,744,801)**

Notes: 2027 SCC is presented as this is the first full year that Alternatives A and B are planned to begin operation. 3% discount rate used. Costs based on global impacts.

Social cost of Methane and Nitrous Oxide values are not presented because they are each insignificant, <1%, with regard to direct combustion emissions from all alternatives, when compared to the social cost of carbon, i.e., $CO^{2.}$ However, they are calculated and presented in the GHG Life Cycle Analysis.

$ = U.S. Dollars; mt = metric tons; SCC = Social Cost of Carbon

Table 3.7-5 - CUF Coal Retirement/Replacement EIS - Net Social Benefit of GHG Operational Emissions Reductions for Alternatives A, B, and C - Only Direct Impact TVA Facilities (2027) - Prior Administration SCC Rates

GHG Pollutant	(Abbrev.)	Nominal SCC Rate ($/mt) (2027)	Nominal SCC Rate ($/ton) (2027)	Net SCC Benefit - Alternative A (2027, Dollars)	Net SCC Benefit - Alternative B - Johnsonville (2027, Dollars)	Net SCC Benefit - Alternative B - Gleason (2027, Dollars)	Net SCC Benefit - Alternative B - Total (2027, Dollars)	Net SCC Benefit - Alternative C (2027, Dollars)
Carbon Dioxide	CO2	$ 8	$ 7	**$ (54,176,292)**	**$ (33,428,775)**	**$ (34,258,067)**	**$ (67,686,842)**	**$ (73,500,000)**

Notes: 2027 SCC is presented as this is the first full year that Alternatives A and B are planned to begin operation. 3% discount rate used. Costs based on U.S. impacts only.

Social cost of Methane and Nitrous Oxide values are not presented because they are each insignificant, <1%, with regard to direct combustion emissions from all alternatives, when compared to the social cost of carbon, i.e., $CO_{2.}$ However, they are calculated and presented in the GHG Life Cycle Analysis.

$ = U.S. Dollars; mt = metric tons; SCC = Social Cost of Carbon

Biden Administration Communication - Technical Support Document: Social Cost of Carbon, Methane, Nitrous Oxide - Interim Estimates under Executive Order 13990 - Feb. 2021 (Appendix A Tables, 3% Discount Rate)
Converted to Nominal Dollars using 2% inflation annual rate approximation; then converted those rates to $/short ton (ton)

	2% Inflation Adjustor	Real SCC ($/mt)	Nominal SCC ($/mt)	**Nominal SCC ($/ton)**
2020	1.00	$ 51	$ 51	$ 46
2021	1.02	$ 52	$ 53	$ 48
2022	1.04	$ 53	$ 55	$ 50
2023	1.06	$ 54	$ 57	$ 52
2024	1.08	$ 55	$ 60	$ 54
2025	1.10	$ 56	$ 62	$ 56
2026	1.13	$ 57	$ 64	$ 58
2027	1.15	$ 59	$ 68	$ 61
2028	1.17	$ 60	$ 70	$ 64
2029	1.20	$ 61	$ 73	$ 66
2030	1.22	$ 62	$ 76	$ 69
2031	1.24	$ 63	$ 78	$ 71
2032	1.27	$ 64	$ 81	$ 74
2033	1.29	$ 65	$ 84	$ 76
2034	1.32	$ 66	$ 87	$ 79
2035	1.35	$ 67	$ 90	$ 82
2036	1.37	$ 69	$ 95	$ 86
2037	1.40	$ 70	$ 98	$ 89
2038	1.43	$ 71	$ 101	$ 92
2039	1.46	$ 72	$ 105	$ 95
2040	1.49	$ 73	$ 108	$ 98
2041	1.52	$ 74	$ 112	$ 102
2042	1.55	$ 75	$ 116	$ 105
2043	1.58	$ 77	$ 121	$ 110
2044	1.61	$ 78	$ 125	$ 114
2045	1.64	$ 79	$ 130	$ 118
2046	1.67	$ 80	$ 134	$ 121
2047	1.71	$ 81	$ 138	$ 125
2048	1.74	$ 82	$ 143	$ 130
2049	1.78	$ 84	$ 149	$ 135
2050	1.81	$ 85	$ 154	$ 140

Federal Government's Social Cost of Carbon - Estimates Used in Conducting Regulatory Impact Analyses under Prior EPA Administration, 2020 (3% Discount Rate)

	Nominal SCC ($/mt) [1]	**Nominal SCC ($/ton)**
2020	$ 7.0	$ 6
2021	$ 7.1	$ 6
2022	$ 7.2	$ 7
2023	$ 7.3	$ 7
2024	$ 7.4	$ 7
2025	$ 7.5	$ 7
2026	$ 7.6	$ 7
2027	$ 7.7	$ 7
2028	$ 7.8	$ 7
2029	$ 7.9	$ 7
2030	$ 8.0	$ 7
2031	$ 8.1	$ 7
2032	$ 8.2	$ 7
2033	$ 8.3	$ 8
2034	$ 8.4	$ 8
2035	$ 8.5	$ 8
2036	$ 8.6	$ 8
2037	$ 8.7	$ 8
2038	$ 8.8	$ 8
2039	$ 8.9	$ 8
2040	$ 9.0	$ 8
2041	$ 9.2	$ 8
2042	$ 9.4	$ 9
2043	$ 9.6	$ 9
2044	$ 9.8	$ 9
2045	$ 10.0	$ 9
2046	$ 10.2	$ 9
2047	$ 10.4	$ 9
2048	$ 10.6	$ 10
2049	$ 10.8	$ 10
2050	$ 11.0	$ 10

[1] Under the prior Administration, federal estimates of the social cost of carbon dioxide were originally reported in 2016 U.S. dollars in EPA's regulatory impact analysis for the 2019 Affordable Clean Energy Rule. The Government Accountability Office (GAO) adjusted the values for inflation and expressed them in 2018 U.S. dollars using the United States Gross Domestic Product Price Index from the U.S. Department of Commerce, Bureau of Economic Analysis. The GAO source document is cited as: U.S. Government Accountability Office, Report to Congressional Requesters, Social Cost of Carbon, Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis (GAO-20-254), June 2020.

CO^2 rates for years between 2020 and 2030, between 2030 and 2040, and between 2040 and 2050 were prorated as only 2020, 2030, 2040, and 2050 rates were provided in the reference.

	CUF - Alternative A	Johnsonville - Alternative B	Gleason - Alternative B	Total - Alternative B	Solar/Battery Storage - Alternative C
CUF EIS Alternatives Net Change in CO_2 emissions (2027) (tons/yr)	-7,739,470	-4,775,539	-4,894,010	-9,669,549	-10,500,000
CUF EIS Alternatives Net Change in CO_2 emissions (2027) (metric tons/yr)	-7,021,131	-4,332,298	-4,439,772	-8,772,070	-9,525,443
CUF EIS Alternatives Net Change in CO_2 emissions (2027) (Million metric tons/yr)	-7.0	-4.3	-4.4	-8.8	-9.5
2018 Tennessee CO_2 emissions from Energy Consumption (Million metric tons)	94.7	94.7	94.7	94.7	94.7
2020 U.S. CO_2 emissions from Energy Consumption (Million metric tons)	4,576.3	4,576.3	4,576.3	4,576.3	4,576.3
2020 Global CO_2 emissions from Energy Consumption (Million metric tons)	31,500.0	31,500.0	31,500.0	31,500.0	31,500.0
% of Tennessee CO_2 emissions from Energy Consumption	-7.41	-4.57	-4.69	-9.26	-10.06
% of U.S. CO_2 emissions from Energy Consumption	-0.15	-0.09	-0.10	-0.19	-0.21
% of Global CO_2 emissions from Energy Consumption	-0.02	-0.01	-0.01	-0.03	-0.03

Combined Cycle (CC) Gas Turbines at TVA Cumberland: Two CC Generation Trains

Table 1. Operational Data

Parameter	Value	Units	Comment
Total Generation	1,450	MW	Total generation for two CC trains
Design Max. Natural Gas Amount	221	MMscf/day	where "MM" denotes "10^6"
Annual Average Capacity Factor	55	%	Energy Information Agency (EIA) CC industry average over the last 10 years; from EIA website: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a
Natural Gas Heat Content	1,020	Btu/scf	AP-42, Section 3.1 - Stationary Gas Turbines, Table 3.1-2a, footnote c, average natural gas heating value (HHV) of 1,020 Btu/scf at 60 degrees F.
Annual Avg Natrl Gas Usage	45,253,065	MMBtu/yr	Average natural gas usage over the life of each CC train

Table 2. Expected Emission Limits/Factors

Constituent		Value	Units	Comment
Nitrogen Oxides (as NO2)	NO2	2.0	ppmvd [1]	Expected SCR performance (based on BACT of comparable CC units) achieved over the life of the plant
Carbon Monoxide	CO	2.0	ppmvd [1]	Manufacturer's guarantee (based on BACT of comparable CC units)
Volatile Organic Compounds	VOC	2.0	ppmvd [1]	Manufacturer's guarantee (based on BACT of comparable CC units)
Filterable PM/TSP	FPM	4.20E-03	lb/MMBtu	USEPA RBLC Database, 2016-2021, avg. after leaving out lowest and highest
Total PM10/2.5	TPM2.5	6.70E-03	lb/MMBtu	USEPA RBLC Database, 2016-2021, avg. after leaving out lowest and highest
Sulfur Dioxide	SO2	6.00E-04	lb/MMBtu	40 CFR Part 75, Appendix D, 2.3.1.1.1, default SO2 emission rate for firing pipeline natural gas
Ammonia Slip	NH3	5.0	ppmvd [1]	Engineering estimate of unreacted SCR ammonia (ammonia slip)
Carbon Dioxide	CO2	120	lb/MMBtu	40 CFR Part 60, Subpart TTTT
Methane	CH4	8.60E-03	lb/MMBtu	EPA AP-42, Vol. I, 5th Ed., Section 3.1 - Stationary Gas Turbines - Supp. F, 4/00, Table 3.1-2a
Nitrous Oxide	N2O	3.00E-03	lb/MMBtu	EPA AP-42, Vol. I, 5th Ed., Section 3.1 - Stationary Gas Turbines - Supp. F, 4/00, Table 3.1-2a

Tbl 2 [1] Concentration in parts-per-million (ppm) by volume, dry-basis (ppmvd), at 15% O2; concentration is converted to an emission factor (lb/MMBtu) via the following:

EF (lb/MMBtu) = ppmvd * Fd * 20.9 / (20.9 - %O2d) * MW / 385.3

where… "ppmvd" denotes constituent concentration;

"Fd" is the 40 CFR 60, App. A, Ref. Method 19, Table 19-2, dry-basis "F-Factor": 8710 dscf/MMBtu;

"%O2d" is the (ref. method) percent oxygen, dry-basis: 15 %;

"MW" is molecular weight (lb/lbmol): NO2 = 46.01 CO = 28.01 VOC* = 16.04 NH3 = 17.03

*VOC as methane, which is representative of the highest stack-exit concentration guaranteed by the manufacturer

The molar volume of any ideal gas at standard temp. and pressure is 385.3 lbmol/scf

Table 3. Emission Estimates [1]

Constituent		Value	Units	Note
Nitrogen Oxides (as NO2)	NO2	167	tons/yr	
Carbon Monoxide	CO	102	tons/yr	
VOC as CH4	VOC	58	tons/yr	
Filterable PM/TSP	FPM	95	tons/yr	
Total PM10/2.5	TPM2.5	152	tons/yr	
Sulfur Dioxide	SO2	14	tons/yr	
Ammonia Slip	NH3	154	tons/yr	
Carbon Dioxide	CO2	2,715,184	tons/yr	
Methane	CH4	195	tons/yr	
Nitrous Oxide	N2O	68	tons/yr	
CO2 equivalent	CO2e	2,740,277	tons/yr	2

Tbl 3 [1] Estimates based on the following: E (tons/year) = EF * Annual Avg Natrl Gas Usage / 2000 * No. of Units

Tbl 3 [2] CO2e based on US EPA, Code of Federal Regulations, Title 40, Part 98, Subpart A, Table A-1, as amended 11-29-13 (78 FR 71904), 100-Year Horizon Global Warming Potentials (GWP) of 25 for CH4 and 298 for N2O.

Natural Gas-Fired Auxiliary Boilers

Table 1. Operational Data

Parameter	Value	Units	Comment
Number of Units	2		
Maximum Heat Input (each)	80	MMBtu/hr	
Annual Average Capacity Factor	55	%	Auxilary boilers service the CC trains and will only operate as needed.
Natural Gas Heat Content	1,020	Btu/scf	
Design Max. Natural Gas Amount (each)	385,440	MMBtu/yr	Annual average natural gas usage over the life of the plant

Table 2. Expected Emission Limits/Factors

Constituent		Value	Units	Comment
Nitrogen Oxides (as NO2)	NO2	50	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-1 (Low-NOX Burner)
Carbon Monoxide	CO	84	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-1
Volatile Organic Compounds	VOC	5.5	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Filterable PM/TSP	FPM	1.9	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Total PM10/2.5	TPM2.5	7.6	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Sulfur Dioxide	SO2	0.6	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Carbon Dioxide	CO2	120,000	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Methane	CH4	2.30E+00	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Nitrous Oxide	N2O	6.40E-01	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2

Table 3. Emission Estimates [1]

Constituent		Value	Units	Note
Nitrogen Oxides (as NO2)	NO2	19	tons/yr	
Carbon Monoxide	CO	32	tons/yr	
VOC as CH4	VOC	2	tons/yr	
Filterable PM/TSP	FPM	1	tons/yr	
Total PM10/2.5	TPM2.5	3	tons/yr	
Sulfur Dioxide	SO2	0.2	tons/yr	
Carbon Dioxide	CO2	45,346	tons/yr	
Methane	CH4	1	tons/yr	
Nitrous Oxide	N2O	0	tons/yr	
CO2 equivalent	CO2e	45,440	tons/yr	2

Tbl 3 [1] Estimates based on the following: E (tons/year) = EF / Natrl Gas Heat Content * Annual Avg Natrl Gas Usage / 2000 * No. of Units

Tbl 3 [2] CO2e based on US EPA, Code of Federal Regulations, Title 40, Part 98, Subpart A, Table A-1, as amended 11-29-13 (78 FR 71904), 100-Year Horizon Global Warming Potentials (GWP) of 25 for CH4 and 298 for N2O.

The CC plant will have one diesel fire water pump emergency engine rated at 275 horsepower; however, emissions will be negligible compared to the CC trains and auxilary boilers.
There are no dew point heaters for Alternative A.

Simple Cycle (CT) Gas Turbines at TVA Johnsonville

Table 1. Operational Data

Parameter	Value	Units	Comment
Total Generation	956	MW	Approximated total generation for four frame CT units
Number of CTs	4		
Estimated Max. Heat Input (each)	2,254	MMBtu/hr	CT Desgin basis; where "MM" denotes "10^6"
Annual Average Capacity Factor	10	%	Energy Information Agency (EIA) CT industry average over the last 10 years; from EIA website: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a
Natural Gas Heat Content	1,020	Btu/scf	AP-42, Section 3.1 - Stationary Gas Turbines, Table 3.1-2a, footnote c, average natural gas heating value (HHV) of 1,020 Btu/scf at 60 degrees F.
Annual Avg Natrl Gas Usage (each)	1,974,504	MMBtu/yr	Average natural gas usage over the life of each CT

Table 2. Expected Emission Limits/Factors

Constituent		Value	Units	Comment
Nitrogen Oxides (as NO2)	NO2	9.0	ppmvd [1]	Manufacturer's guarantee (based on BACT of comparable CC units)
Carbon Monoxide	CO	9.0	ppmvd [1]	Manufacturer's guarantee (based on BACT of comparable CC units)
Volatile Organic Compounds	VOC	1.9	ppmvd [1]	USEPA RBLC Database, 2016-2021, avg. after leaving out lowest and highest
Filterable PM/TSP	FPM	1.90E-03	lb/MMBtu	EPA AP-42, Vol. I, 5th Ed., Section 3.1 - Stationary Gas Turbines - Supp. F, 4/00, Table 3.1-2a
Total PM10/2.5	TPM2.5	7.60E-03	lb/MMBtu	USEPA RBLC Database, 2016-2021, avg. after leaving out lowest and highest
Sulfur Dioxide	SO2	6.00E-04	lb/MMBtu	40 CFR Part 75, Appendix D, 2.3.1.1.1, default SO2 emission rate for firing pipeline natural gas
Carbon Dioxide	CO2	120	lb/MMBtu	40 CFR Part 60, Subpart TTTT
Methane	CH4	8.60E-03	lb/MMBtu	EPA AP-42, Vol. I, 5th Ed., Section 3.1 - Stationary Gas Turbines - Supp. F, 4/00, Table 3.1-2a
Nitrous Oxide	N2O	3.00E-03	lb/MMBtu	EPA AP-42, Vol. I, 5th Ed., Section 3.1 - Stationary Gas Turbines - Supp. F, 4/00, Table 3.1-2a

Tbl 2 [1] Concentration in parts-per-million (ppm) by volume, dry-basis (ppmvd), at 15% O2; concentration is converted to an emission factor (lb/MMBtu) via the following:

EF (lb/MMBtu) = ppmvd * Fd * 20.9 / (20.9 - %O2d) * MW / 385.3

where… "ppmvd" denotes constituent concentration;

"Fd" is the 40 CFR 60, App. A, Ref. Method 19, Table 19-2, dry-basis "F-Factor": 8710 dscf/MMBtu;

"%O2d" is the (ref. method) percent oxygen, dry-basis: 15 %;

"MW" is molecular weight (lb/lbmol): NO2 = 46.01 CO = 28.01 VOC* = 16.04

*VOC as methane, which is representative of the highest stack-exit concentration guaranteed by the manufacturer

The molar volume of any ideal gas at standard temp. and pressure is 385.3 lbmol/scf

Table 3. Emission Estimates [1]

Constituent		Value	Units	Note
Nitrogen Oxides (as NO2)	NO2	131	tons/yr	
Carbon Monoxide	CO	80	tons/yr	
VOC as CH4	VOC	10	tons/yr	
Filterable PM/TSP	FPM	8	tons/yr	
Total PM10/2.5	TPM2.5	30	tons/yr	
Sulfur Dioxide	SO2	2	tons/yr	
Carbon Dioxide	CO2	473,881	tons/yr	
Methane	CH4	34	tons/yr	
Nitrous Oxide	N2O	12	tons/yr	
CO2 equivalent	CO2e	478,260	tons/yr	2

Tbl 3 [1] Estimates based on the following: E (tons/year) = EF * Annual Avg Natrl Gas Usage / 2000 * No. of Units

Tbl 3 [2] CO2e based on US EPA, Code of Federal Regulations, Title 40, Part 98, Subpart A, Table A-1, as amended 11-29-13 (78 FR 71904), 100-Year Horizon Global Warming Potentials (GWP) of 28 for CH4 and 298 for N2O.

Natural Gas-Fired Dew-Point Gas Heaters

Table 1. Operational Data

Parameter	Value	Units	Comment
Number of Units	3		
Maximum Heat Input (each)	7.5	MMBtu/hr	Each heater will only operate at 50 % of their maximum heat input capacity.
Annual Average Capacity Factor	10	%	Gas heaters service the CT units and will only operate as needed.
Natural Gas Heat Content	1,020	Btu/scf	
Design Max. Natural Gas Amount (each)	3,285	MMBtu/yr	Annual average natural gas usage over the life of the plant

Table 2. Expected Emission Limits/Factors

Constituent		Value	Units	Comment
Nitrogen Oxides (as NO2)	NO2	50	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-1 (Low-NOX Burner)
Carbon Monoxide	CO	84	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-1
Volatile Organic Compounds	VOC	5.5	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Filterable PM/TSP	FPM	1.9	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Total PM10/2.5	TPM2.5	7.6	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Sulfur Dioxide	SO2	0.6	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Carbon Dioxide	CO2	120,000	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Methane	CH4	2.30E+00	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Nitrous Oxide	N2O	6.40E-01	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2

Table 3. Emission Estimates [1]

Constituent		Value	Units	Note
Nitrogen Oxides (as NO2)	NO2	0.2	tons/yr	
Carbon Monoxide	CO	0.4	tons/yr	
VOC as CH4	VOC	0.03	tons/yr	
Filterable PM/TSP	FPM	0.01	tons/yr	
Total PM10/2.5	TPM2.5	0.04	tons/yr	
Sulfur Dioxide	SO2	0.003	tons/yr	
Carbon Dioxide	CO2	580	tons/yr	
Methane	CH4	0.01	tons/yr	
Nitrous Oxide	N2O	0.003	tons/yr	
CO2 equivalent	CO2e	581	tons/yr	2

Tbl 3 [1] Estimates based on the following: E (tons/year) = EF / Natrl Gas Heat Content * Annual Avg Natrl Gas Usage / 2000 * No. of Units

Tbl 3 [2] CO2e based on US EPA, Code of Federal Regulations, Title 40, Part 98, Subpart A, Table A-1, as amended 11-29-13 (78 FR 71904), 100-Year Horizon Global Warming Potentials (GWP) of 25 for CH4 and 298 for N2O.

Simple Cycle Gas Turbines at TVA Gleason

Table 1. Operational Data

Parameter	Value	Units	Comment
Total Generation	717	MW	Approximated total generation for three frame CT units
Number of CTs	3		
Estimated Max. Heat Input (each)	2,254	MMBtu/hr	CT Desgin basis; where "MM" denotes "10^6"
Annual Average Capacity Factor	10	%	Energy Information Agency (EIA) CT industry average over the last 10 years; from EIA website: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a
Natural Gas Heat Content	1,020	Btu/scf	AP-42, Section 3.1 - Stationary Gas Turbines, Table 3.1-2a, footnote c, average natural gas heating value (HHV) of 1,020 Btu/scf at 60 degrees F.
Annual Avg Natrl Gas Usage (each)	1,974,504	MMBtu/yr	Average natural gas usage over the life each CT

Table 2. Expected Emission Limits/Factors

Constituent		Value	Units	Comment
Nitrogen Oxides (as NO2)	NO2	9.0	ppmvd [1]	Manufacturer's guarantee (based on BACT of comparable CC units)
Carbon Monoxide	CO	9.0	ppmvd [1]	Manufacturer's guarantee (based on BACT of comparable CC units)
Volatile Organic Compounds	VOC	1.9	ppmvd [1]	USEPA RBLC Database, 2016-2021, avg. after leaving out lowest and highest
Filterable PM/TSP	FPM	1.90E-03	lb/MMBtu	EPA AP-42, Vol. I, 5th Ed., Section 3.1 - Stationary Gas Turbines - Supp. F, 4/00, Table 3.1-2a
Total PM10/2.5	TPM2.5	7.60E-03	lb/MMBtu	USEPA RBLC Database, 2016-2021, avg. after leaving out lowest and highest
Sulfur Dioxide	SO2	6.00E-04	lb/MMBtu	40 CFR Part 75, Appendix D, 2.3.1.1.1, default SO2 emission rate for firing pipeline natural gas
Carbon Dioxide	CO2	120	lb/MMBtu	40 CFR Part 60, Subpart TTTT
Methane	CH4	8.60E-03	lb/MMBtu	EPA AP-42, Vol. I, 5th Ed., Section 3.1 - Stationary Gas Turbines - Supp. F, 4/00, Table 3.1-2a
Nitrous Oxide	N2O	3.00E-03	lb/MMBtu	EPA AP-42, Vol. I, 5th Ed., Section 3.1 - Stationary Gas Turbines - Supp. F, 4/00, Table 3.1-2a

Tbl 2 [1] Concentration in parts-per-million (ppm) by volume, dry-basis (ppmvd), at 15% O2; concentration is converted to an emission factor (lb/MMBtu) via the following:

EF (lb/MMBtu) = ppmvd * Fd * 20.9 / (20.9 - %O2d) * MW / 385.3

where… "ppmvd" denotes constituent concentration;

"Fd" is the 40 CFR 60, App. A, Ref. Method 19, Table 19-2, dry-basis "F-Factor": 8710 dscf/MMBtu;

"%O2d" is the (ref. method) percent oxygen, dry-basis: 15 %;

"MW" is molecular weight (lb/lbmol): NO2 = 46.01 CO = 28.01 VOC* = 16.04

*VOC as methane, which is representative of the highest stack-exit concentration guaranteed by the manufacturer

The molar volume of any ideal gas at standard temp. and pressure is 385.3 lbmol/scf

Table 3. Emission Estimates [1]

Constituent		Value	Units	Note
Nitrogen Oxides (as NO2)	NO2	98	tons/yr	
Carbon Monoxide	CO	60	tons/yr	
VOC as CH4	VOC	7	tons/yr	
Filterable PM/TSP	FPM	6	tons/yr	
Total PM10/2.5	TPM2.5	23	tons/yr	
Sulfur Dioxide	SO2	2	tons/yr	
Carbon Dioxide	CO2	355,411	tons/yr	
Methane	CH4	25	tons/yr	
Nitrous Oxide	N2O	9	tons/yr	
CO2 equivalent	CO2e	358,695	tons/yr	2

Tbl 3 [1] Estimates based on the following: E (tons/year) = EF * Annual Avg Natrl Gas Usage / 2000 * No. of Units

Tbl 3 [2] CO2e based on US EPA, Code of Federal Regulations, Title 40, Part 98, Subpart A, Table A-1, as amended 11-29-13 (78 FR 71904), 100-Year Horizon Global Warming Potentials (GWP) of 28 for CH4 and 298 for N2O.

Natural Gas-Fired Dew-Point Gas Heaters

Table 1. Operational Data

Parameter	Value	Units	Comment
Number of Units	3		
Maximum Heat Input (each)	7.5	MMBtu/hr	Each heater will only operate at 50 % of their maximum heat input capacity.
Annual Average Capacity Factor	10	%	Gas heaters service the CT units and will only operate as needed.
Natural Gas Heat Content	1,020	Btu/scf	
Design Max. Natural Gas Amount (each)	3,285	MMBtu/yr	Annual average natural gas usage over the life of the plant

Table 2. Expected Emission Limits/Factors

Constituent		Value	Units	Comment
Nitrogen Oxides (as NO2)	NO2	50	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-1 (Low-NOX Burner)
Carbon Monoxide	CO	84	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-1
Volatile Organic Compounds	VOC	5.5	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Filterable PM/TSP	FPM	1.9	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Total PM10/2.5	TPM2.5	7.6	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Sulfur Dioxide	SO2	0.6	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Carbon Dioxide	CO2	120,000	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Methane	CH4	2.30E+00	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2
Nitrous Oxide	N2O	6.40E-01	lb/MMscf	EPA AP-42, Vol. I, 5th Ed., Sec. 1.4 - Natural Gas Combustion - Supp. D, 4/98, Table 1.4-2

Table 3. Emission Estimates [1]

Constituent		Value	Units	Note
Nitrogen Oxides (as NO2)	NO2	0.2	tons/yr	
Carbon Monoxide	CO	0.4	tons/yr	
VOC as CH4	VOC	0.03	tons/yr	
Filterable PM/TSP	FPM	0.01	tons/yr	
Total PM10/2.5	TPM2.5	0.04	tons/yr	
Sulfur Dioxide	SO2	0.003	tons/yr	
Carbon Dioxide	CO2	580	tons/yr	
Methane	CH4	0.01	tons/yr	
Nitrous Oxide	N2O	0.003	tons/yr	
CO2 equivalent	CO2e	581	tons/yr	2

Tbl 3 [1] Estimates based on the following: E (tons/year) = EF / Natrl Gas Heat Content * Annual Avg Natrl Gas Usage / 2000 * No. of Units

Tbl 3 [2] CO2e based on US EPA, Code of Federal Regulations, Title 40, Part 98, Subpart A, Table A-1, as amended 11-29-13 (78 FR 71904), 100-Year Horizon Global Warming Potentials (GWP) of 25 for CH4 and 298 for N2O.

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Appendix I – Life Cycle Analysis of Greenhouse Gas Emissions

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APPENDIX I
GREENHOUSE GAS EMISSIONS LIFE CYCLE ANALYSES OF CUMBERLAND RETIREMENT ALTERNATIVES

I.1. Introduction

This appendix explains the methodology and provides the emissions calculations and results of the Life Cycle Analyses (LCAs) of greenhouse gases (GHGs) emissions for each of the four alternative actions, on both an individual replacement resource by alternative basis (henceforth "individual") and a TVA system-wide portfolio basis with simulated generation dispatch (henceforth "system-wide"). The GHGs included in this analysis are carbon dioxide (CO_2), methane (CH_4), and nitrous dioxide (N_2O) as these are the GHGs of concern in association with the Proposed Action. Additionally, these three GHGs are the ones specifically emphasized in the January 2021 Executive Order 13990 regarding capturing the social costs of GHGs. The life cycle GHG emissions results were used to calculate the social cost of carbon (SCC), social cost of methane (SCM), and social cost of nitrous oxide (SCN) values for each alternative, as well as the total social cost of the three GHGs for each alternative (SC-GHG). Social costs were calculated and presented in nominal dollars and in terms of Net Present Value (NPV) in 2021 dollars.

The life cycle emissions and SC-GHG emissions for each alternative, calculated as described in this Appendix for both the individual replacement resource by alternative basis and the TVA system-wide portfolio basis, are summarized in Section 3.7.2 of this EIS.

All tables referenced below are provided in Section I.6 of this Appendix, except for four summary tables provided in Section I.4 for the total SC-GHGs for each alternative for both the individual basis LCA and TVA system-wide basis LCA.

I.2. Methodology/Basis

The basis for these LCAs is National Renewable Energy Laboratory (NREL) publications that provide harmonized CO_2-equivalent (CO_2-e) life cycle emission factors for each of the different life cycle segments of the generating technologies being considered. The NREL's LCA harmonization process included reviews of approximately 3,000 published LCA studies of a variety of utility-scale electrical generation and storage technologies. The NREL harmonization process included three rounds of screening by multiple experts to select references that met strict criteria for quality, relevance, and transparency. The NREL references provided a range of life cycle emission factors for each technology; the median published life cycle emission factors were used in the calculations described here. These NREL references were considered the most appropriate and complete references currently available for calculating emissions from all life cycle segments for the electricity generation technologies in this EIS.

The life cycle segments included in the NREL publications include the following with their descriptions:

- <u>One-Time Upstream</u> includes GHG emissions from resource extraction/production, processing/conversion, material manufacturing, component manufacturing, delivery to site, and construction for plant/technology components. This LCA assumes One-Time Upstream costs are all for the year 2026.

- Ongoing Annual Combustion includes GHG emissions from combustion of fuels at the proposed facilities over the entire operational life cycle of the technology.[1]
- Ongoing Annual Non-Combustion includes GHG emissions from plant operations activities other than fuel combustion, plant maintenance activities, and the fuel cycle GHG emissions, i.e., fuel extraction/processing/distribution/transport (includes pipelines) and coal bed methane.
- One-Time Downstream includes dismantling, decommissioning, disposal, and recycling of the plant/technology. This LCA assumes One-Time Downstream costs are all in 2057 for Alternatives A and B and 2047 for Alternative C.

Although data on methane leaks from natural gas technologies is provided in the NREL publications, this parameter was not harmonized by NREL. However, the natural gas LCAs reviewed by NREL that passed their strict criteria included methane leakage in terms of a percent of total natural gas production and use. These values for LCAs conducted in the U.S. were averaged to obtain a representative cumulative methane leakage rate of 1.6 percent over the life cycle of the proposed CC and CT plants. This 1.6 percent of total natural gas flow leakage rate was used to calculate methane emissions from the natural gas technologies in Alternatives A and B. A separate line item for methane leak emissions from natural gas technologies is provided in this LCA because it is not included in the Ongoing Annual Non-Combustion emission factor per interpretation of the natural gas NREL LCA harmonization publication.

The life cycle emission factors in the NREL publications were only provided in terms of CO_2-equivalent emissions (in grams) per kilowatt-hour of electricity production. To disaggregate the CO_2-e emission factors into emission factors for each of the three individual GHGs, the individual GWP-weighted contributions of CO_2, CH_4, and N_2O to their total CO_2-e emission factors are prorated based on their relative contribution from the *USEPA Emission Factors for GHG Inventories, Table 6 - Electricity under Total Output Emission Factors for the eGRID Subregion of SERC Tennessee Valley*. These emission factors are 834.2 lb/MW-hr for CO_2, 0.075 lb/MW-hr for CH_4, and 0.011 lb/MW-hr for N_2O. Using these values, the percent contribution of CO_2, CH_4, and N_2O to the CO_2-e emission factor is 99.99%, 0.009%, and 0.001%, respectively. For the coal technology, this prorating was not necessary as the NREL coal LCA publication provided the mean GWP-weighted contribution of CH_4 and N_2O to CO_2-e as approximately 5% and <1% (assumed 0.9%), respectively, so that the CO_2 contribution is 94.1%. The emission factors used for the LCAs are provided in Tables I.6.1 through I.6.4 for CO_2-e, CO_2, CH_4 and N_2O emissions, respectively.

None of the emission factors in the NREL LCA harmonization publications include transmission and distribution (T&D) electricity losses as they were outside the scope of the NREL studies and are not considered appreciably different for each EIS alternative.

The assumptions and conditions defining the electricity generation rates for supporting each alternative's life cycle emissions calculations are provided below. These generation rates are based on the projected average annual lifetime electricity generation. Table I.6.5 provides the assumptions, conditions, and projected average annual electricity generation lifetime rates in kw-hours per year. The maximum capacity annual electricity generation rates are provided for coal and natural gas technologies only to show the basis for calculating the average annual lifetime rates.

[1] The Ongoing Annual Combustion emission factors in the NREL references were not used because those combustion emissions were calculated using alternative-specific design, operational, and regulatory information. These emission factors were instead based on the specifications of the proposed CC and CT plants.

- No Action Alternative – Coal Technology
  - Plant size – 2,470 Megawatts (MW)
  - Projected average annual lifetime generation – assumed approximately 55% capacity factor based on U.S. Energy Information Administration (EIA) industry averages over the last 10 years; obtained from EIA website: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a

- Alternative A – Natural Gas Combined Cycle Combustion Turbine Technology
  - Plant size – 1,450 MW
  - Projected average annual lifetime generation – assumed approximately 55% capacity factor based on EIA industry averages over the last 10 years; obtained from EIA website: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a. Based on TVA's experience and industry knowledge, actual CC capacity factors for any given plant in any given year may vary between about 35% and about 90% depending on factors such as load growth, natural gas prices, composition of the balance of TVA's generating fleet in any given year, outages, or other unforeseen circumstances.

- Alternative B – Natural Gas Simple Cycle Combustion Turbine Technology
  - Plant sizes – 884 MW at Johnsonville; 663 MW at Gleason
  - Projected average annual lifetime generation – assumed approximately 10% capacity factor based on EIA industry averages over the last 10 years; obtained from EIA website: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a. Based on TVA's experience and industry knowledge, actual CT capacity factors for any given plant in any given year may vary between about 1% and about 35 % depending on factors such as load growth, natural gas prices, composition of the balance of TVA's generating fleet in any given year, outages, or other unforeseen circumstances.

- Alternative C – Solar Panel/Battey Storage Technology
  - Plant sizes – 3,000 MW Solar; 1,700 MW battery storage
  - Projected average annual lifetime generation – assumed 25% capacity factor for solar and 16.7% capacity factor for battery storage. Solar basis is based on typical responses to recent TVA RFPs for utility-scale, single axis tracking solar facilities. Battery basis is from an NREL publication on 4-hour duration utility scale battery energy storage systems: https://atb.nrel.gov/electricity/2021/utility-scale_battery_storage
  - Additional assumptions – battery storage calculations assume 1 full cycle/day (5 hours to charge from the grid and 4 hours to discharge to grid = 9 hours/cycle). Battery efficiency is assumed to be 85% based on typical responses to recent TVA RFPs for utility-scale battery storage systems.

Life cycle operational time for CC turbines under Alternative A and CT turbines under Alternative B is 30 years. TVA typically models solar and battery storage as 20-year Power Purchase Agreements, and assumes operational time for solar panels/battery storage under Alternative C is 20 years. However, to provide a consistent life cycle comparison across all alternatives, the solar/battery storage alternative was prorated to 30 years by scaling up 20-year emissions by a factor of 1.5; 20 x 1.5 = 30. The life cycle operational time for the No Action Alternative was extended to the same 30-year period as the other alternatives but only for

obtaining an equivalent comparison. It is expected the coal plant would be retired by the end of 2028; the first unit in 2026 and the other unit in 2028.

The system-wide lifecycle analysis builds off the assumptions presented above, while also considering net changes in generation supplied by the remaining TVA fleet on an ongoing basis as compared to the No Action Alternative for 20 years. Carbon dioxide emissions are pulled directly from TVA models, while nitrous oxide and methane emissions use factors based on annual electricity generation by resource type. One-time upstream emissions are assumed to occur in 2026, while one-time downstream emissions occur in 2057 (the first year following the 30-year asset life) and are discounted to the year 2042, which is the end of the 20-year study period. Ongoing annual combustion and non-combustion emissions are accounted for in the year emitted.

I.3. GHG Life Cycle Emissions for Each Alternative

On an individual basis, the estimated life cycle CO_2 emissions for each alternative are provided in Table I.6.6. The estimated life cycle CH_4 emissions for each alternative are provided in Tables I.6.7. The estimated methane leakage emissions for Alternative A and B are provided in Table I.6.8 and I.6.9, respectively. The estimated life cycle N_2O emissions for each alternative are provided in Table I.6.10. Tables I.6.6, I.6.7, and I.6.10 also show the emissions for each life cycle segment.

On a system-wide basis, as a delta compared to the No Action Alternative, the estimated change in life cycle CO_2 emissions for each alternative are provided in Table I.6.25. The estimated change in life cycle CH_4 emissions, including methane leakage, for each alternative are provided in Tables I.6.26. The estimated life cycle N_2O emissions for each alternative are provided in Table I.6.27.

I.4. Life Cycle Social Costs of GHGs for Each Alternative

The GHG life cycle emissions described above were multiplied by social cost values[2], in dollars per short ton (converted from dollars per metric ton), under the following Biden Administration Interagency Working Group on Social Cost of GHGs document (IWG 2021): Technical Support Document, Social Cost of Carbon - Interim Estimates under Biden Administration Executive Order 13990, February 2021 (Appendix A, Table A-1, 3% discount rates). The social costs for each of the three GHGs were calculated in this manner using their individual values for the years covering the life cycle period. The social costs for each GHG were summed to obtain a total GHG life cycle social cost. For each alternative, on an individual basis, Table I.6.11 provides the estimated life cycle social costs of CO_2 emissions, including for each life cycle segment. Tables I.6.13 and I.6.15 provide the same information for CH_4 and N_2O, respectively and on an individual basis. Table I.6.17 provides the summary of life cycle GHG social costs (based on IWG 2021 social cost values) for each of the alternatives, on an individual basis. Tables I.6.12, I.6.14, and I.6.16 provide the Biden Administration social cost value tables by year for CO_2, CH_4, and N_2O respectively, on an individual basis. The main information in Table I.6.17 is summarized below in Table I.4.1.

[2] The social cost values in the Technical Support Document were converted to nominal values using a 2% per year inflation rate.

Table I.4.1 – Individual Basis Total Life Cycle Social Cost of GHG Emissions under Biden Administration SC-GHG Values

Electricity Power Technology	Total Life Cycle Social Cost of GHG Emissions, Nominal $	NPV of Total Life Cycle Social Costs of GHG Emissions, 2021 $
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency in comparing alternatives	**$34,917,574,550**	**$8,667,836,231**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	**$12,152,610,379**	**$3,010,697,631**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	**$3,543,253,259**	**$876,316,344**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years for consistency in comparing alternatives)	$1,501,448,221	$976,603,644
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years for consistency in comparing alternatives)	$132,721,056	$74,415,648
Alternative C - Total Life Cycle Social Cost of GHG Emissions, $	**$1,634,169,277**	**$1,051,019,292**

Due to legal uncertainties surrounding the use of social cost values for GHGs, TVA has decided to provide a range for GHG life cycle social costs using the current and previous presidential administration's social cost values for GHGs. Presenting social costs as a range of values, as estimated by two different Administrations, provides decisionmakers and the public with better information to make an informed decision. Under the prior administration, federal estimates of the SCC were originally reported in 2016 U.S. dollars in the USEPA's regulatory impact analysis for the 2019 Affordable Clean Energy Rule. The Government Accountability Office (GAO) adjusted the values for inflation and expressed them in 2018 U.S. dollars at a 3% discount rate using the United States Gross Domestic Product Price Index from the U.S. Department of Commerce, Bureau of Economic Analysis. In a similar manner, federal estimates of the SCM were originally reported in 2016 U.S. dollars in the Bureau of Land Management's (BLM's) regulatory impact analysis for the 2018 Final Rule to Rescind or Revise Certain Requirements of the 2016 Waste Prevention Rule. The GAO adjusted the values for inflation and expressed them in 2018 U.S. dollars at a 3% discount rate in the same manner as for CO_2; however, the estimates were only provided to 2030. These values were then interpolated through the life cycle period, which is to 2057. The GAO did not find a recent rulemaking that used monetary estimates for N_2O that were based directly on the SCC approach. Instead, GAO used a National Highway Traffic Safety Administration (NHTSA) rulemaking where the N_2O Global Warming Potential factor, i.e., 298, was used to convert USEPA's SCC value estimates to monetary value estimates for N_2O.

Using the prior administration values, the social costs for each of the three GHGs were calculated using their individual values for the years covering the life cycle period. The social costs for each GHG were summed to obtain a total GHG life cycle social cost. For each alternative, Table I.6.18 provides the estimated life cycle SCC emissions, on an individual basis. Tables I.6.20 and I.6.22 provide the same information but for SCM and SCN, respectively and on an individual basis. Tables I.6.18, I.6.20, and I.6.22 also show the SCC, SCM, and SCN, respectively, for each life cycle segment, on an individual basis. Table I.6.24 provides the summary of SC-GHG (based on prior administration cost values) for each of the alternatives on an individual basis. The main information in Table I.6.24 is summarized below in Table I.4.2. Tables I.6.19, I.6.21, and I.6.23 provide the prior administration social cost value tables by year for CO_2, CH_4, and N_2O, respectively.

The one-time upstream SC- GHGs conservatively assumed they were all incurred in the year 2026. The one-time downstream SC-GHGs assumed they were all incurred in the year 2057 for all alternatives.

Table I.4.2 – Individual Basis Total Life Cycle Social Cost of GHG Emissions under Prior Administration SC-GHG Values

Electricity Power Technology	Total Life Cycle Social Cost of GHG Emissions, Nominal $	NPV of Total Life Cycle Social Costs of CHG Emissions, 2021 $
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency in comparing alternatives	**$2,820,017,291**	**$766,912,309**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	**$971,427,632**	**$266,322,092**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	**$282,898,649**	**$76,852,188**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years for consistency in comparing alternatives)	$121,439,914	$78,989,512
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years for consistency in comparing alternatives)	$13,740,059	$8,749,187
Alternative C - Total Life Cycle Social Cost of GHG Emissions, $	**$135,179,973**	**$87,738,699**

As stated in Section 3.7, a system-wide view provides critical context to how the specific resource retirements and replacements, underpinning the assumptions of each proposed action alternatives, integrates to the system overall, and completes the overall characterization of total system impact and performance. Developing a system-wide life cycle analysis reflects TVA's broader asset strategy and target power supply mix set by the 2019 IRP. A TVA system-wide comparison of emissions, shown as a delta compared to No Action Alternative, is the most effective way to accurately identify incremental emission differences between the alternatives because it illustrates how the entire TVA system is expected to operate with each alternative. Using the same Biden Administration costs described previously for each emission type, the social costs for each of the three GHGs were calculated using their individual values for the years covering the 20-year life cycle period modeled. The social costs for each GHG were summed to obtain a total GHG life cycle social cost. For each alternative, Table I.6.28 provides the estimated life cycle SCC emissions, including for each life cycle segment. Tables I.6.29 and I.6.30 provides the same information for SCM and SCN, respectively. Table I.4.3 below provides the summary of life cycle SC-GHG (based on IWG 2021 social cost values) for each of the alternatives.

Using the prior administration values, the social costs of the system-wide delta compared to the No Action Alternative for each of the three GHGs were calculated for the years covering the 20-year life cycle period. The social costs for each GHG were summed to obtain a total GHG life cycle social cost. For each alternative, Table I.6.31 provides the estimated life cycle SCC emissions on a system-wide delta compared to the No Action Alternative basis. Tables I.6.32 and I.6.33 provide the same information but for SCM and SCN, respectively and on a system-wide delta compared to No Action Alternative basis. Table I.4.4 below provides the summary of life cycle GHG social costs (based on prior administration estimates) for each of the alternatives.

Table I.4.3 – TVA System-Wide Estimated Social Cost of Life Cycle GHG Emissions for Action Alternatives Compared to the No Action Alternative, by Life Cycle Phase (Biden)

Proposed Action Alternatives	One-Time Upstream (Nominal $)	Ongoing Combustion (Nominal $)	Ongoing Non-Combustion (Nominal $)	Methane Leakage (Nominal $)	One-Time Downstream (Nominal $)	Total (Nominal $)	NPV (2021 $)
Alternative A							
CO2	840,414,483	(12,697,868,888)	408,465,812	NA	802,526	(11,448,186,067)	(4,267,500,566)
CH4	1,224	11	(162,002,783)	806	107	(162,000,636)	(59,564,383)
N2O	133	(36)	(330,819,345)	NA	0	(330,819,248)	(122,244,047)
Alternative A Total	**840,415,840**	**(12,697,868,913)**	**(84,356,316)**	**806**	**802,632**	**(11,941,005,950)**	**(4,449,308,996)**
Alternative B							
CO2	365,425	(11,181,511,584)	1,217,967,896	NA	23,351	(9,963,154,911)	(3,688,176,474)
CH4	42	10	(158,472,409)	878	3	(158,471,476)	(57,632,610)
N2O	5	(38)	(323,449,682)	NA	0	(323,449,715)	(118,190,865)
Alternative B Total	**365,471**	**(11,181,511,612)**	**736,045,805**	**878**	**23,354**	**(10,445,076,103)**	**(3,863,999,949)**
Alternative C							
CO2	829,284,390	(14,479,093,167)	706,500,635	NA	101,883,394	(12,841,424,749)	(4,598,965,759)
CH4	94,286	4	(161,453,920)	546	36,434	(161,322,649)	(58,996,039)
N2O	10,254	(64)	(328,384,852)	NA	1,001	(328,373,661)	(120,686,463)
Alternative C Total	**829,388,929**	**(14,479,093,227)**	**216,661,863**	**546**	**101,920,830**	**(13,331,121,059)**	**(4,778,648,261)**

Table I.4.4 – TVA System-Wide Estimated Social Cost of Life Cycle GHG Emissions for Action Alternatives Compared to the No Action Alternative, by Life Cycle Phase (Prior Administration)

Proposed Action Alternatives	One-Time Upstream (Nominal $)	Ongoing Combustion (Nominal $)	Ongoing Non-Combustion (Nominal $)	Methane Leakage (Nominal $)	One-Time Downstream (Nominal $)	Total (Nominal $)	NPV (2021 $)
Alternative A							
CO2	1,293,613	(1,168,887,271)	114,072,562	NA	55,441	(1,053,465,655)	(403,144,217)
CH4	132	1	(14,208,849)	71	6	(14,208,640)	(5,364,757)
N2O	13	(3)	(24,054,600)	NA	0	(24,054,590)	(9,179,479)
Alternative A Total	**1,293,758**	**(1,168,887,272)**	**75,809,113**	**71**	**55,447**	**(1,091,728,884)**	**(417,688,452)**
Alternative B							
CO2	43,914	(1,027,028,763)	111,505,266	NA	1,613	(915,477,970)	(347,415,882)
CH4	4	1	(13,853,682)	76	0	(13,853,600)	(5,168,655)
N2O	0	(3)	(23,418,288)	NA	0	(23,418,290)	(8,825,692)
Alternative B Total	**43,919**	**(1,027,028,764)**	**74,233,296**	**76**	**1,613**	**(952,749,860)**	**(361,410,229)**
Alternative C							
CO2	99,656,869	(1,335,434,809)	64,027,933	NA	11,964,811	(1,159,785,196)	(421,438,970)
CH4	10,177	0	(14,138,712)	47	2,053	(14,126,435)	(5,302,767)
N2O	982	(5)	(23,827,906)	NA	96	(23,826,833)	(9,039,876)
Alternative C Total	**99,668,028**	**(1,335,434,813)**	**26,061,315**	**47**	**11,966,959**	**(1,197,738,464)**	**(435,781,614)**

I.5. LCA References

- Nicholson, S., and G. Heath. 2021. Life Cycle Emissions Factors for Electricity Generation Technologies. National Renewable Energy Laboratory (NREL). 10.7799/1819907. Accessed online: <https://data.nrel.gov/submissions/171>. File name: EF_Table_FINAL.xls. Accessed on 15 August 2022. [This reference includes the lithium-ion battery storage emission factors utilized for this LCA]

- Whitaker, M., G. A. Heath, P. O'Donoughue, and M. Vorum. 2012. Life Cycle Greenhouse Gas Emissions of Coal-Fired Electricity Generation, Systematic Review and Harmonization. Journal of Industrial Ecology. https://onlinelibrary.wiley.com/doi/10.1111/j.1530-9290.2012.00465.x.

- O'Donoghue, P., G. A. Heath, S. L. Dolan, and M. Vorum. 2014. Life Cycle Greenhouse Gas Emissions of Electricity Generated from Conventionally Produced Natural Gas, Systematic Review and Harmonization. Journal of Industrial Ecology. https://doi.org/10.1111/jiec.12084.

- Hsu D., P. O'Donoughue, V. Fthenakis, G. Heath, H. C. Kim, P. Sawyer, J.-K. Choi, and D. Turney. 2012. Life Cycle Greenhouse Gas Emissions of Crystalline Silicon Photovoltaic Electricity Generation: Systematic Review and Harmonization. Journal of Industrial Ecology. DOI: 10.1111/j.1530-9290.2011.00439.x.

- Interagency Working Group (IWG) 2021. Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide, Interim Estimates under Executive Order 13990. Interagency Working Group on Social Cost of Greenhouse Gases, United States Government. (Appendix A, Table A-1, 3% Discount Rate)

- U.S. Government Accountability Office, Report to Congressional Requesters, Social Cost of Carbon, Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis (GAO-20-254), June 2020.

I.6. Tables with Estimated LCA GHG Emission Factors, GHG Emissions, and Social Cost of GHG Emissions, for Individual and System-Wide Analyses

Table I.6.1. Median Published Life Cycle CO_2 Equivalent Emission Factors for Electricity Generation Technologies, by Life Cycle Phase

Electric Power Technology	One-Time Upstream GHG (CO_2 equivalent), g/kW-hr	Ongoing Annual Combustion GHG (CO_2 equivalent), g/kW-hr	Ongoing Annual Non-Combustion GHG (CO_2 equivalent), g/kW-hr	One-Time Downstream GHG (CO_2 equivalent), g/kW-hr	Total Life Cycle (CO_2 equivalent), g/kW-hr
Coal (Supercritical pulverized)(1)	4.9	NU	4.9	4.9	NA1
Natural Gas - CCs	0.8	NU	62	0.02	NA1
Natural Gas - CTs	0.14	NU	70	0.003	NA1
Solar Panels (2)	NR	NA2	NR	NR	64
Li-Ion Battery Storage	31.5	NA2	NR	3.4	34.9

Sources: Nicholson et al. 2021, Whitaker et al. 2012, O'Donoughue et al. 2014, and Hsu et al. 2012.

g = grams; kW = kilowatts; hr = hours
CC = Combined Cycle Gas Turbine Plant
CT = Simple-Cycle Gas Turbine Plant
NU = Emission factors in NREL references were Not Used; GHG emissions from ongoing annual combustion were calculated separately using proposed action alternatives and existing coal plant specific design/operating information.
NA1 = Not Applicable; emission factors/rates for each applicable life cycle segment were used instead of the total life cycle emission factor in the NREL reference.
NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.
NR = Not Reported in the NREL references.

NOTES:
None of the emission factors in the NREL LCA harmonization reference documents include Transmission and Distribution (T&D) electricity losses as they were outside the scope of the NREL studies and are not considered appreciably different for each Alternative.
(1) = Assumed <5 g/kW-hr values in the source document table are 4.9 g/kW-hr
(2) = Assumed Solar panels are Mono-Silicon type technology.

Table I.6.2. Estimated Life Cycle CO_2 Emission Factors for Electricity Generation Technologies, by Life Cycle Phase

Electric Power Technology	One-Time Upstream CO_2, g/kW-hr	Ongoing Annual Combustion CO_2, g/kW-hr	Ongoing Annual Non-Combustion CO_2, g/kW-hr	One-Time Downstream CO_2, g/kW-hr	Total Life Cycle CO_2, g/kW-hr
Coal (Supercritical pulverized)	4.61	NU	4.61	4.61	NA1
Natural Gas - CCs	7.999E-01	NU	6.199E+01	1.9998E-02	NA1
Natural Gas - CTs	1.3999E-01	NU	6.9993E+01	2.9997E-03	NA1
Solar	NR	NA2	NR	NR	63.99
Li-Ion Battery Storage	31.4969	NA2	NR	3.3997	34.8965

Source: Calculated based on sources footnoted in Table I.6-1

g = grams; kW = kilowatts; hr = hours
CC = Combined Cycle Gas Turbine Plant
CT = Simple-Cycle Gas Turbine Plant
NU = Emission factors in NREL references were Not Used; GHG emissions from ongoing annual combustion were calculated separately using proposed action alternatives and existing coal plant specific design/operating information.
NA1 = Not Applicable; emission factors/rates for each applicable life cycle segment were used instead of the total life cycle emission factor in the NREL reference.
NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.
NR = Not Reported in the NREL references.

NOTES:
See text for assumptions on GSP-weighted contributions of CO_2, CH_4, and N_2O to CO_2-e.

Table I.6.3. Estimated Life Cycle CH_4 Emission Factors for Electricity Generation Technologies, by Life Cycle Phase

Electric Power Technology	One-Time Upstream CH_4, g/kW-hr (GWP-weighted)	Ongoing Annual Combustion CH_4, g/kW-hr (GWP-weighted)	Ongoing Annual Non-Combustion CH_4, g/kW-hr (GWP-weighted)	One-Time Downstream CH_4, g/kW-hr (GWP-weighted)	Total Life Cycle CH_4, g/kW-hr (GWP-weighted)	Methane Leakage (% of NG Production)
Coal (Supercritical pulverized)	0.25	NU	0.25	0.25	NA1	NA3
Natural Gas - CCs	7.200E-05	NU	5.580E-03	1.800E-06	NA1	1.6
Natural Gas - CTs	1.260E-05	NU	6.300E-03	2.700E-07	NA1	1.6
Solar	NR	NA2	NR	NR	0.01	NA3
Li-Ion Battery Storage	2.84E-03	NA2	NR	3.06E-04	3.14E-03	NA3

Source: Calculated based on sources footnoted in Table I.6-1

NA3 = Not Applicable: methane leakage due to direct natural gas use is not applicable to coal, solar, and battery storage; coal bed methane releases is accounted for under the ongoing annual non-combustion emission factor.

The Natural Gas NREL reference above lists Methane Leakage rates in percent of natural gas production for various Life Cycle Analyses (LCAs) in the U.S. and their average value, based on 21 LCAs, is rounded to 1.6 based on data in Table 1. Assumed this leakage is not included in the Ongoing Annual Non-Combustion emission factor per interpretation of the Natural Gas NREL LCA harmonization reference.

Table I.6.4. Estimated Life Cycle N_2O Emission Factors for Electricity Generation Technologies, by Life Cycle Phase

Electric Power Technology	One-Time Upstream N_2O, g/kW-hr (GWP-weighted)	Ongoing Annual Combustion N_2O, g/kW-hr (GWP-weighted)	Ongoing Annual Non-Combustion N_2O, g/kW-hr (GWP-weighted)	One-Time Downstream N_2O, g/kW-hr (GWP-weighted)	Total Life Cycle N_2O, g/kW-hr (GWP-weighted)
Coal (Supercritical pulverized)	0.04	NU	0.04	0.04	NA1
Natural Gas - CCs	8.000E-06	NU	6.200E-04	2.000E-07	NA1
Natural Gas - CTs	1.400E-06	NU	7.000E-04	3.000E-08	NA1
Solar	NR	NA2	NR	NR	6.40E-04
Li-Ion Battery Storage	3.15E-04	NA2	NR	3.40E-05	3.49E-04

Source: Calculated based on sources footnoted in Table I.6-1

Table I.6.5. Electricity Generation Assumptions for Each Alternative

Electricity Generation Technology	Electricity Generation Annual Rate (kW-hr/year)	Plant Size (MW)	Alternative
Coal kW-hr/year (max. capacity generation)	21,637,200,000	2470	No Action
Coal kW-hr/year (projected average annual lifetime generation)	11,900,460,000		
CC kW-hr/year (max. capacity generation)	12,702,000,000	1450	A
CC kW-hr/year (projected average annual lifetime generation)	6,986,100,000		
4x CT kW-hr/year (max. capacity generation)	2,942,659,200	884	B
4x CT kW-hr/year (projected average annual lifetime generation)	774,384,000		B
3x CT kW-hr/year (max. capacity generation)	2,206,994,400	663	
3x CT kW-hr/year (projected average annual lifetime generation)	580,788,000		
Solar kW-hr/year (projected average annual lifetime generation)	6,570,000,000	3000	C
Li-Ion Battery Storage kW-hr/year (projected average annual lifetime generation discharged)	2,482,000,000	1700	C

Supporting Information: Conversion, Acronyms, Capacity Factors

grams to lbs conversion: 0.00220462

CC = Natural Gas Turbine Combined Cycle

CF = Capacity Factor

CT = Natural Gas Turbine Simple Cycle

Max. Generation for CC/Coal @ 100% CF, CTs @ 38% CF, Solar/Battery @ 30% CF

Projected Average Annual Lifetime Generation CC/Coal @ 55% CF, CTs @ 10% CF, Solar @ 25% CF, Battery @ 16.7% CF

Batteries assume max. of 2 full cycles/day (5 hours to charge from the grid and 4 hours to discharge to grid = 9 hours/cycle). 1 cycle/day is assumed to be the predicted actual operation. Battery efficiency is assumed to be 85% based on TVA historical model data.

Table I.6.6. Estimated Life Cycle CO_2 Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production

Electricity Generation Technology	One-Time Upstream CO_2 Emissions, tons	Ongoing Annual Combustion CO_2 Emissions, tons/yr	Ongoing Annual Non-Combustion CO_2 Emissions, tons/yr	One-Time Downstream CO_2 Emissions, tons	Total Life Cycle CO_2 Emissions, tons
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency	1,814,573	10,500,000	60,486	1,814,573	**320,443,719**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	184,802	2,760,530	477,405	4,620	**97,327,461**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	6,273	830,451	104,557	134	**28,056,648**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	NC	NA2	NC	NC	13,903,589
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	1,723,466	NA2	NC	186,025	2,864,236
Alternative C - Total Life Cycle CO_2 Emissions, tons					**16,767,825**

NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.

NC = Not Calculated separately; incorporated in the total life cycle emissions.

See text for assumptions on GSP-weighted contributions of CO_2, CH_4, and N_2O to CO_2-e.

Table I.6.7. Estimated Life Cycle CH4 Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production

Electricity Generation Technology	One-Time Upstream CH_4 Emissions, tons	Ongoing Annual Combustion CH_4 Emissions, tons/yr	Ongoing Annual Non-Combustion CH_4 Emissions, tons/yr	One-Time Downstream CH_4 Emissions, tons	Methane Life Cycle Leakage, tons	Total Life Cycle CH_4 Emissions, tons
No Action Alternative -Coal (Supercritical pulverized); assumed 30-years remaining life for consistency	3,856.7	114	128.6	3,856.7	NA3	**14,990**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	0.7	196	1.7	0.02	409,656	**415,573**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	0.02	60	0.4	4.840E-04	127,623	**129,419**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	NC	NA2	NC	NC	NA3	**50**
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	6	NA2	NC	0.7	NC2	**10**
Alternative C - Total Life Cycle CH_4 Emissions, tons						**60**

NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.

NA3 = Not Applicable: methane leakage due to natural gas use is not applicable to coal and solar; coal bed methane releases is accounted for under the ongoing annual non-combustion emissions.

NC = Not Calculated separately; incorporated in the total life cycle emissions.

NC2 = Not Calculated separately; Methane leak emissions due to grid power generation from natural gas plants for charging the batteries is incorporated into TVA system wide GHG emissions analysis.

See text for assumptions on GSP-weighted contributions of CO_2, CH_4, and N_2O to CO_2-e.

Table I.6.8. Estimated Methane Leak Emissions, Average Annual Lifetime - Alternative A

121,550,000	NG scf/day use at Cumberland CCGT
94	Estimated Methane portion of NG (percent)
114,257,000	Methane scf/day use at Cumberland CCGT
0.657	Methane density (kg/m3)
0.0283168	conversion, 1 cubic foot = 0.0283168 cubic meters
27,310,389	Methane Release Emissions (lbs/yr) from NG use at Cumberland CCGT
13,655	**Methane Release Emissions (tons/yr) from NG use at Cumberland CCGT**

Table I.6.9. Estimated Methane Leak Emissions, Average Annual Lifetime - Alternative B

1,578	NG MMBtu/hr (Johnsonville + Gleason CTs)
37,867,200	NG scf/day use at Johnsonville + Gleason CTs
94	Estimated Methane portion of NG (percent)
35,595,168	Methane scf/day use at Johnsonville + Gleason CTs
0.657	Methane density (kg/m3)
0.0283168	conversion, 1 cubic foot = 0.0283168 cubic meters
8,508,169	Methane Release Emissions (lbs/yr) from NG use at Johnsonville + Gleason CTs
4,254	**Methane Release Emissions (tons/yr) from NG use at Johnsonville + Gleason CTs**

Table I.6.10. Estimated Life Cycle N2O Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production

Electricity Generation Technology	One-Time Upstream N_2O Emissions, tons	Ongoing Annual Combustion N_2O Emissions, tons/yr	Ongoing Annual Non-Combustion N_2O Emissions, tons/yr	One-Time Downstream N_2O Emissions, tons	Total Life Cycle N_2O Emissions, tons
No Action Alternative -Coal(Supercritical pulverized); assumed 30-years remaining life for consistency	58.24	179	1.94	58	**5,554**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	6.20E-03	68	0.02	1.55E-04	**2,043**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	2.11E-04	21	3.51E-03	4.51E-06	**624**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	NC	NA2	NC	NC	**0.5**
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	0.1	NA2	NC	0.01	**0.1**
Alternative C - Total Life Cycle N_2O Emissions, tons					**0.6**

NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.

NC = Not Calculated separately; incorporated in the total life cycle emissions.

See text for assumptions on GSP-weighted contributions of CO_2, CH_4, and N_2O to CO_2-e.

Table I.6.11. Estimated Social Cost of Life Cycle CO2 Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production (Biden Administration EO 13990 Interim Rates, 3% Discount Rates)

Electricity Generation Technology	One-Time Upstream Social Cost of CO_2 Emissions, $	Ongoing Combustion Social Cost of CO_2 Emissions, $/LC	Ongoing Non-Combustion Social Cost of CO_2 Emissions, $/LC	One-Time Downstream Social Cost of CO_2 Emissions, $	Total Life Cycle Social Cost of CO_2 Emissions, $
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency	$105,698,481	$34,012,126,769	$195,928,534	$315,200,605	**$34,628,954,389**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	$10,764,668	$8,942,046,620	$1,546,433,657	$802,526	**$10,500,047,470**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	$365,425	$2,690,038,866	$338,686,016	$23,351	**$3,029,,113,658**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	NC	NA2	NC	NC	$1,501,240,075
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	$100,391,498	NA2	NC	$32,313,470	$132,704,968
Alternative C Total Life Cycle Social Cost of CO_2 Emissions, $					**$1,633,945,043**

LC = Life Cycle period

NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.

NC = Not Calculated separately; incorporated in the total life cycle emissions.

NPV = Net Present Value

Assumed One-Time Upstream costs are all in 2026.

Assumed One-Time Downstream costs are all in 2057 for Alt. A and B and 2047 for Alt. C.

For Solar NPV calculations, assumed 90% of total life cycle costs are the Upstream costs and 10% are the Downstream costs based on approximate relative comparison in emissions for these segments under Battery Storage.

Table I.6.12. Technical Support Document: Social Cost of Carbon - Interim Estimates under Biden Administration Executive Order 13990 - Feb. 2021 (Appendix A, Table A-1, 3% Discount Rate)

Year	2% Inflation Adjustor	Real SC-CO_2 ($/mt)	Nominal SC-CO_2 ($/mt)	Nominal SC-CO_2 ($/ton)
2020	1.00	$ 51	$ 51	$ 46
2021	1.02	$ 52	$ 53	$ 48
2022	1.04	$ 53	$ 55	$ 50
2023	1.06	$ 54	$ 57	$ 52
2024	1.08	$ 55	$ 60	$ 54
2025	1.10	$ 56	$ 62	$ 56
2026	1.13	$ 57	$ 64	$ 58
2027	1.15	$ 59	$ 68	$ 61
2028	1.17	$ 60	$ 70	$ 64
2029	1.20	$ 61	$ 73	$ 66
2030	1.22	$ 62	$ 76	$ 69
2031	1.24	$ 63	$ 78	$ 71
2032	1.27	$ 64	$ 81	$ 74
2033	1.29	$ 65	$ 84	$ 76
2034	1.32	$ 66	$ 87	$ 79
2035	1.35	$ 67	$ 90	$ 82
2036	1.37	$ 69	$ 95	$ 86
2037	1.40	$ 70	$ 98	$ 89
2038	1.43	$ 71	$ 101	$ 92
2039	1.46	$ 72	$ 105	$ 95
2040	1.49	$ 73	$ 108	$ 98
2041	1.52	$ 74	$ 112	$ 102
2042	1.55	$ 75	$ 116	$ 105
2043	1.58	$ 77	$ 121	$ 110
2044	1.61	$ 78	$ 125	$ 114
2045	1.64	$ 79	$ 130	$ 118
2046	1.67	$ 80	$ 134	$ 121
2047	1.71	$ 81	$ 138	$ 125
2048	1.74	$ 82	$ 143	$ 130
2049	1.78	$ 84	$ 149	$ 135
2050	1.81	$ 85	$ 154	$ 140
2051	1.85	$ 86	$ 159	$ 144
2052	1.88	$ 87	$ 164	$ 149

Year	2% Inflation Adjustor	Real SC-CO_2 ($/mt)	Nominal SC-CO_2 ($/mt)	Nominal SC-CO_2 ($/ton)
2053	1.92	$ 88	$ 169	$ 153
2054	1.96	$ 89	$ 175	$ 158
2055	2.00	$ 90	$ 180	$ 163
2056	2.04	$ 91	$ 186	$ 168
2057	2.08	$ 92	$ 191	$ 174

Converted to Nominal Dollars using 2% inflation annual rate approximation; then converted those values to $/short ton (ton)

$ = U.S. Dollars; mt = metric tons; SC-CO_2 = Social Cost of Carbon Dioxide; SC-CH_4 = Social Cost of Methane; SC-N_2O = Social Cost of Nitrous Oxide

Real CO_2 values for years 2051 through 2057 were assumed to increase $1/mt per year based on a similar rate of increase in previous years.

Table I.6.13. Estimated Social Cost of Life Cycle CH4 Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production (Biden Administration EO 13990 Interim Values, 3% Discount Rates)

Electricity Power Technology	One-Time Upstream Social Cost of CH_4 Emissions, $	Ongoing Combustion Social Cost of CH_4 Emissions, $/LC	Ongoing Non-Combustion Social Cost of CH_4 Emissions, $/LC	One-Time Downstream Social Cost of CH_4 Emissions, $	Methane Leakage Social Cost of CH_4, $	Total Life Cycle Social Cost of CH_4 Emissions, $
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency	$7,094,255	$12,906,820	$14,554,858	$24,758,168	NA3	**$59,314,101**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	$1,224	$22,134,064	$194,602	$107	$1,546,010,009	**$1,568,340,006**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	$42	$6,736,454	$42,620	$3	$481,637,764	**$488,416,883**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	NC	NA2	NC	NC	NA3	$188,915
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	$11,414	NA2	NC	$3,008	NC2	$14,422
Alternative C Total Life Cycle Social Cost of CH_4 Emissions, $						**$203,337**

LC = Life Cycle period
NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.

NA3 = Not Applicable: methane leakage due to natural gas use is not applicable to coal and solar; coal bed methane releases is accounted for under the ongoing annual non-combustion emissions.
NC = Not Calculated separately; incorporated in the total life cycle emissions.
NC2 = Not Calculated separately; Methane leak emissions due to grid power generation from natural gas plants for charging the batteries is incorporated into TVA system wide GHG emissions analysis.
Assumed One-Time Upstream costs are all in 2026.
Assumed One-Time Downstream costs are all in 2057 for Alt. A and B and 2047 for Alt. C.
For Solar NPV calculations, assumed 90% of total life cycle costs are the Upstream costs and 10% are the Downstream costs based on approximate relative comparison in emissions for these segments under Battery Storage.

Table I.6.14. Technical Support Document: Social Cost of Methane - Interim Estimates under Biden Administration Executive Order 13990 - Feb. 2021 (Appendix A, Table A-2, 3% Discount Rate)

Year	2% Inflation Adjustor	Real SC-CH_4 ($/mt)	Nominal SC-CH_4 ($/mt)	Nominal SC-CH_4 ($/ton)
2020	1.00	$1,500	$ 1,500	$ 1,361
2021	1.02	$1,500	$ 1,530	$ 1,388
2022	1.04	$1,600	$ 1,665	$ 1,511
2023	1.06	$1,600	$ 1,698	$ 1,541
2024	1.08	$1,700	$ 1,840	$ 1,670
2025	1.10	$1,700	$ 1,877	$ 1,703
2026	1.13	$1,800	$ 2,027	$ 1,839
2027	1.15	$1,800	$ 2,068	$ 1,876
2028	1.17	$1,900	$ 2,226	$ 2,020
2029	1.20	$1,900	$ 2,271	$ 2,061
2030	1.22	$2,000	$ 2,438	$ 2,212
2031	1.24	$2,000	$ 2,487	$ 2,257
2032	1.27	$2,100	$ 2,663	$ 2,417
2033	1.29	$2,100	$ 2,717	$ 2,465
2034	1.32	$2,200	$ 2,903	$ 2,634
2035	1.35	$2,200	$ 2,961	$ 2,687
2036	1.37	$2,300	$ 3,157	$ 2,865
2037	1.40	$2,300	$ 3,221	$ 2,922
2038	1.43	$2,400	$ 3,428	$ 3,111
2039	1.46	$2,500	$ 3,642	$ 3,305
2040	1.49	$2,500	$ 3,715	$ 3,371
2041	1.52	$2,600	$ 3,941	$ 3,576
2042	1.55	$2,600	$ 4,020	$ 3,648
2043	1.58	$2,700	$ 4,258	$ 3,864
2044	1.61	$2,700	$ 4,343	$ 3,941
2045	1.64	$2,800	$ 4,594	$ 4,169
2046	1.67	$2,800	$ 4,686	$ 4,252
2047	1.71	$2,900	$ 4,950	$ 4,492
2048	1.74	$3,000	$ 5,223	$ 4,740
2049	1.78	$3,000	$ 5,328	$ 4,834
2050	1.81	$3,100	$ 5,615	$ 5,095
2051	1.85	$3,100	$ 5,728	$ 5,197
2052	1.88	$3,200	$ 6,031	$ 5,472

Year	2% Inflation Adjustor	Real SC-CH_4 ($/mt)	Nominal SC-CH_4 ($/mt)	Nominal SC-CH_4 ($/ton)
2053	1.92	$3,200	$ 6,151	$ 5,582
2054	1.96	$3,300	$ 6,470	$ 5,871
2055	2.00	$3,300	$ 6,600	$ 5,989
2056	2.04	$3,400	$ 6,936	$ 6,294
2057	2.08	$3,400	$ 7,074	$ 6,420

Converted to Nominal Dollars using 2% inflation annual rate approximation; then converted those values to $/short ton (ton)

$ = U.S. Dollars; mt = metric tons; SC-CO_2 = Social Cost of Carbon Dioxide; SC-CH_4 = Social Cost of Methane; SC-N_2O = Social Cost of Nitrous Oxide

Real CH_4 values for years 2051 through 2057 were assumed to increase by $100/mt every two years based on a similar rate of increase in previous years.

Table I.6.15. Estimated Social Cost of Life Cycle N2O Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production (Biden Administration EO 13990 Interim Values, 3% Discount Rates)

Electricity Power Technology	One-Time Upstream Social Cost of N_2O Emissions, $/LC	Ongoing Combustion Social Cost of N_2O Emissions, $/LC	Ongoing Non-Combustion Social Cost of N_2O Emissions, $/LC	One-Time Downstream Social Cost of N_2O Emissions, $/LC	Total Life Cycle Social Cost of N_2O Emissions, $
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency	$1,249,827	$221,697,338	$2,400,325	$3,958,570	**$229,306,059**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	$133	$84,202,949	$19,810	$11	**$84,222,903**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	$5	$25,718,375	$4,339	$0	**$25,722,718**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	NC	NA2	NC	NC	$19,231
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	$1,241	NA2	NC	$424	$1,666
Alternative C Total Life Cycle Social Cost of N_2O Emissions, $					**$20,897**

LC = Life Cycle period

NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.

NC = Not Calculated separately; incorporated in the total life cycle emissions.

Assumed One-Time Upstream costs are all in 2026.

Assumed One-Time Downstream costs are all in 2057 for Alt. A and B and 2047 for Alt. C.
For Solar NPV calculations, assumed 90% of total life cycle costs are the Upstream costs and 10% are the Downstream costs based on approximate relative comparison in emissions for these segments under Battery Storage.

Table I.6.16. Technical Support Document: Social Cost of Nitrous Oxide - Interim Estimates under Biden Administration Executive Order 13990 - Feb. 2021 (Appendix A, Table A-3, 3% Discount Rate)

Year	2% Inflation Adjustor	Real SC-N_2O ($/mt)	Nominal SC-N_2O ($/mt)	Nominal SC-N_2O ($/ton)
2020	1.00	$18,000	$18,000	$16,334
2021	1.02	$19,000	$19,380	$17,586
2022	1.04	$19,000	$19,768	$17,938
2023	1.06	$20,000	$21,224	$19,260
2024	1.08	$20,000	$21,649	$19,645
2025	1.10	$21,000	$23,186	$21,040
2026	1.13	$21,000	$23,649	$21,460
2027	1.15	$21,000	$24,122	$21,890
2028	1.17	$22,000	$25,777	$23,391
2029	1.20	$22,000	$26,292	$23,858
2030	1.22	$23,000	$28,037	$25,442
2031	1.24	$23,000	$28,598	$25,951
2032	1.27	$24,000	$30,438	$27,621
2033	1.29	$24,000	$31,047	$28,173
2034	1.32	$25,000	$32,987	$29,934
2035	1.35	$25,000	$33,647	$30,532
2036	1.37	$26,000	$35,692	$32,389
2037	1.40	$26,000	$36,406	$33,037
2038	1.43	$27,000	$38,563	$34,993
2039	1.46	$27,000	$39,334	$35,693
2040	1.49	$28,000	$41,607	$37,755
2041	1.52	$28,000	$42,439	$38,511
2042	1.55	$29,000	$44,833	$40,684
2043	1.58	$29,000	$45,730	$41,497
2044	1.61	$30,000	$48,253	$43,787
2045	1.64	$30,000	$49,218	$44,663
2046	1.67	$31,000	$51,876	$47,074
2047	1.71	$31,000	$52,913	$48,016
2048	1.74	$32,000	$55,713	$50,556
2049	1.78	$32,000	$56,827	$51,567
2050	1.81	$33,000	$59,775	$54,242
2051	1.85	$33,000	$60,970	$55,327
2052	1.88	$34,000	$64,074	$58,144

Year	2% Inflation Adjustor	Real SC-N_2O ($/mt)	Nominal SC-N_2O ($/mt)	Nominal SC-N_2O ($/ton)
2053	1.92	$34,000	$65,356	$59,307
2054	1.96	$35,000	$68,624	$62,272
2055	2.00	$35,000	$69,996	$63,517
2056	2.04	$36,000	$73,436	$66,639
2057	2.08	$36,000	$74,905	$67,972

Converted to Nominal Dollars using 2% inflation annual rate approximation; then converted those values to $/short ton (ton)

$ = U.S. Dollars; mt = metric tons; SC-CO_2 = Social Cost of Carbon Dioxide; SC-CH_4 = Social Cost of Methane; SC-N_2O = Social Cost of Nitrous Oxide

Real N_2O values for years 2051 through 2057 were assumed to increase by $1,000/mt every two years based on a similar rate of increase in previous years.

Table I.6.17. Estimated Social Cost of Life Cycle GHG Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production (Biden Administration EO 13990 Interim Values, 3% Discount Rates)

Electricity Power Technology	Total Life Cycle Social Cost of CO_2 Emissions, $	Total Life Cycle Social Cost of CH_4 Emissions, $	Total Life Cycle Social Cost of N_2O Emissions, $	Total Life Cycle Social Cost of GHG Emissions, $
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency	**$34,628,954,389**	**$59,314,101**	**$229,306,059**	**$34,917,574,550**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	**$10,500,047,470**	**$1,568,340,006**	**$84,222,903**	**$12,152,610,379**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	**$3,029,113,658**	**$488,416,883**	**$25,722,718**	**3,543,253,259**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	$1,501,240,075	$188,915	$19,231	$1,501,448,221
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	$132,704,968	$14,422	$1,666	$132,721,056
Alternative C Total Life Cycle Social Cost of GHG Emissions, $	**$1,633,945,043**	**$203,337**	**$20,897**	**$1,634,169,277**

Table I.6.18. Estimated Social Cost of Life Cycle CO2 Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production (Prior Administration Values, 2020, 3% Discount Rates)

Electricity Power Technology	One-Time Upstream Social Cost of CO_2 Emissions, $	Ongoing Combustion Social Cost of CO_2 Emissions, $/LC	Ongoing Non-Combustion Social Cost of CO_2 Emissions, $/LC	One-Time Downstream Social Cost of CO_2 Emissions, $	Total Life Cycle Social Cost of CO_2 Emissions, $
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency	$12,702,011	$2,751,000,000	$15,847,271	$21,774,876	**$2,801,324,159**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	$1,293,613	$723,258,808	$125,080,064	$55,441	**$849,687,925**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	$43,914	$217,578,712	$27,393,913	$1,613	**$245,017,628**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	NC	NA2	NC	NC	$121,424,675
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	$12,064,260	NA2	NC	$1,674,224	$13,738,484
Alternative C Total Life Cycle Social Cost of CO_2 Emissions, $					**$135,163,159**

LC = Life Cycle period

NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.

NC = Not Calculated separately; incorporated in the total life cycle emissions.

Assumed One-Time Upstream costs are all in 2026.

Assumed One-Time Downstream costs are all in 2057 for Alt. A and B and 2047 for Alt. C.

Table I.6.19. Federal Government's Social Cost of Carbon - Estimates Used in Conducting Regulatory Impact Analyses under Prior EPA Administration, 2020 (3% Discount Rate)

Year	Nominal SC-CO_2 [1] ($/mt)	Nominal SC-CO_2 ($/ton)
2020	$7.0	$ 6
2021	$7.1	$ 6
2022	$7.2	$ 7
2023	$7.3	$ 7
2024	$7.4	$ 7
2025	$7.5	$ 7
2026	$7.6	$ 7
2027	$7.7	$ 7
2028	$7.8	$ 7
2029	$7.9	$ 7
2030	$8.0	$ 7
2031	$8.1	$ 7
2032	$8.2	$ 7
2033	$8.3	$ 8
2034	$8.4	$ 8
2035	$8.5	$ 8
2036	$8.6	$ 8
2037	$8.7	$ 8
2038	$8.8	$ 8
2039	$8.9	$ 8
2040	$9.0	$ 8
2041	$9.2	$ 8
2042	$9.4	$ 9
2043	$9.6	$ 9
2044	$9.8	$ 9
2045	$10.0	$ 9
2046	$10.2	$ 9
2047	$10.4	$ 9
2048	$10.6	$ 10
2049	$10.8	$ 10
2050	$11.0	$ 10
2051	$11.2	$ 10
2052	$11.5	$ 10

Year	Nominal SC-CO_2 [1] ($/mt)	Nominal SC-CO_2 ($/ton)
2053	$11.7	$ 11
2054	$12.0	$ 11
2055	$12.3	$ 11
2056	$12.5	$ 11
2057	$12.8	$ 12

$ = U.S. Dollars; mt = metric tons; SC-CO_2 = Social Cost of Carbon Dioxide

1 Under the prior administration, federal estimates of the social cost of carbon dioxide were originally reported in 2016 U.S. dollars in EPA's regulatory impact analysis for the 2019 Affordable Clean Energy Rule. The Government Accountability Office (GAO) adjusted the values for inflation and expressed them in 2018 U.S. dollars using the United States Gross Domestic Product Price Index from the U.S. Department of Commerce, Bureau of Economic Analysis. The GAO source document is cited as: U.S. Government Accountability Office, Report to Congressional Requesters, Social Cost of Carbon, Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis (GAO-20-254), June 2020.

CO_2 values for years between 2020 and 2030, between 2030 and 2040, and between 2040 and 2050 were interpolated as only 2020, 2030, 2040, and 2050 values were provided in the reference.

Table I.6.20. Estimated Social Cost of Life Cycle CH4 Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production (Prior Administration Values, 2020, 3% Discount Rates)

Electricity Power Technology	One-Time Upstream Social Cost of CH_4 Emissions, $	Ongoing Combustion Social Cost of CH_4 Emissions, $/LC	Ongoing Non-Combustion Social Cost of CH_4 Emissions, $/LC	One-Time Downstream Social Cost of CH_4 Emissions, $	Methane Leakage Social Cost of CH_4, $	Total Life Cycle Social Cost of CH_4 Emissions, $
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency	$765,739	$958,034	$1,080,363	$1,394,988	NA3	**$4,199,125**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	$132	$1,642,945	$14,445	$6	$114,755,678	**$116,413,206**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	$4	$500,027	$3,164	$0	$35,750,524	**$36,253,719**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	NC	NA2	NC	NC	NA3	$14,023
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	$1,232	NA2	NC	$207	NC2	$1,439
Alternative C Total Life Cycle Social Cost of CH_4 Emissions, $						**$15,462**

LC = Life Cycle period

NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.

NA3 = Not Applicable: methane leakage due to natural gas use is not applicable to coal and solar; coal bed methane releases is accounted for under the ongoing annual non-combustion emissions.

NC = Not Calculated separately; incorporated in the total life cycle emissions.

NC2 = Not Calculated separately; Methane leak emissions due to grid power generation from natural gas plants for charging the batteries is incorporated into TVA system wide GHG emissions analysis.

Assumed One-Time Upstream costs are all in 2026.

Assumed One-Time Downstream costs are all in 2057 for Alt. A and B and 2047 for Alt. C.

Table I.6.21. Federal Government's Social Cost of Methane - Estimates Used in Conducting Regulatory Impact Analyses under the Prior EPA Administration, 2020 (3% Discount Rate)

Year	Nominal SC-CH4 [1] ($/mt)	Nominal SC-CH4 ($/ton)
2020	$ 184	$ 167
2021	$ 190	$ 172
2022	$ 196	$ 177
2023	$ 201	$ 183
2024	$ 207	$ 188
2025	$ 213	$ 193
2026	$ 219	$ 199
2027	$ 225	$ 204
2028	$ 230	$ 209
2029	$ 236	$ 214
2030	$ 242	$ 220
2031	$ 248	$ 225
2032	$ 254	$ 230
2033	$ 259	$ 235
2034	$ 265	$ 241
2035	$ 271	$ 246
2036	$ 277	$ 251
2037	$ 283	$ 256
2038	$ 288	$ 262
2039	$ 294	$ 267
2040	$ 300	$ 272
2041	$ 306	$ 277
2042	$ 312	$ 283
2043	$ 317	$ 288
2044	$ 323	$ 293
2045	$ 329	$ 299
2046	$ 335	$ 304
2047	$ 341	$ 309
2048	$ 346	$ 314
2049	$ 352	$ 320
2050	$ 358	$ 325
2051	$ 364	$ 330
2052	$ 370	$ 335

Year	Nominal SC-CH4 [1] ($/mt)	Nominal SC-CH4 ($/ton)
2053	$ 375	$ 341
2054	$ 381	$ 346
2055	$ 387	$ 351
2056	$ 393	$ 356
2057	$ 399	$ 362

1 Under the prior administration, federal estimates of the social cost of methane were originally reported in 2016 U.S. dollars in BLM's regulatory impact analysis for the 2018 Final Rule to Rescind or Revise Certain Requirements of the 2016 Waste Prevention Rule. The Government Accountability Office (GAO) adjusted the values for inflation and expressed them in 2018 U.S. dollars using the United States Gross Domestic Product Price Index from the U.S. Department of Commerce, Bureau of Economic Analysis. Unlike EPA, BLM included estimates only to 2030. The GAO source document is cited as: U.S. Government Accountability Office, Report to Congressional Requesters, Social Cost of Carbon, Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis (GAO-20-254), June 2020.

$ = U.S. Dollars; mt = metric tons; SC-CH_4 = Social Cost of Methane

CH_4 values for years between 2020 and 2030 and thereafter were interpolated based on the change in rates between the 2020 and 2030 rates provided.

Table I.6.22. Estimated Social Cost of Life Cycle N2O Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production (Prior Administration Values, 2020, 3% Discount Rates)

Electricity Power Technology	One-Time Upstream Social Cost of N_2O Emissions, $/LC	Ongoing Combustion Social Cost of N_2O Emissions, $/LC	Ongoing Non-Combustion Social Cost of N_2O Emissions, $/LC	One-Time Downstream Social Cost of N_2O Emissions, $/LC	Total Life Cycle Social Cost of N_2O Emissions, $
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency	$119,690	$14,020,772	$151,803	$201,741	**$14,494,007**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	$13	$5,325,235	$1,253	$1	**$5,326,501**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	$0	$1,626,503	$274	$0	**$1,626,778**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	NC	NA2	NC	NC	$1,216
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	$119	NA2	NC	$18	$136
Alternative C Total Life Cycle Social Cost of N_2O Emissions, $					**$1,353**

LC = Life Cycle period

NA2 = Not Applicable; no direct ongoing annual combustion emissions are generated directly from Alternative C solar and battery operations.

NC = Not Calculated separately; incorporated in the total life cycle emissions.

Assumed One-Time Upstream costs are all in 2026.

Assumed One-Time Downstream costs are all in 2057 for Alt. A and B and 2047 for Alt. C.

Table I.6.23. Federal Government's Social Cost of Nitrous Oxide - Estimates Used in Conducting Regulatory Impact Analyses under the Prior EPA Administration, 2020 (3% Discount Rate)

Year	Nominal SC-N_2O [1] ($/mt)	Nominal SC-N_2O ($/ton)
2020	$ 2,086	$ 1,893
2021	$ 2,116	$ 1,920
2022	$ 2,146	$ 1,947
2023	$ 2,175	$ 1,974
2024	$ 2,205	$ 2,001
2025	$ 2,235	$ 2,028
2026	$ 2,265	$ 2,055
2027	$ 2,295	$ 2,082
2028	$ 2,324	$ 2,109
2029	$ 2,354	$ 2,136
2030	$ 2,384	$ 2,163
2031	$ 2,414	$ 2,190
2032	$ 2,444	$ 2,217
2033	$ 2,473	$ 2,244
2034	$ 2,503	$ 2,272
2035	$ 2,533	$ 2,299
2036	$ 2,563	$ 2,326
2037	$ 2,593	$ 2,353
2038	$ 2,622	$ 2,380
2039	$ 2,652	$ 2,407
2040	$ 2,682	$ 2,434
2041	$ 2,742	$ 2,488
2042	$ 2,801	$ 2,542
2043	$ 2,861	$ 2,596
2044	$ 2,920	$ 2,650
2045	$ 2,980	$ 2,704
2046	$ 3,040	$ 2,758
2047	$ 3,099	$ 2,812
2048	$ 3,159	$ 2,866
2049	$ 3,218	$ 2,921
2050	$ 3,278	$ 2,975
2051	$ 3,350	$ 3,040

Year	Nominal SC-N_2O [1] ($/mt)	Nominal SC-N_2O ($/ton)
2052	$ 3,424	$ 3,107
2053	$ 3,499	$ 3,175
2054	$ 3,576	$ 3,245
2055	$ 3,655	$ 3,317
2056	$ 3,735	$ 3,389
2057	$ 3,817	$ 3,464

1 Under the prior administration, the U.S. Government Accountability Office (GAO) did not find a recent rulemaking that used monetary estimates for nitrous oxide that were based on the social cost of carbon approach. Instead, the National Highway Traffic Safety Administration (NHTSA) used a Global Warming Potential factor to convert EPA's social cost carbon dioxide estimates to monetary estimates for nitrous oxide. Monetary estimates the agency used in sensitivity analyses involving nitrous oxide were estimated by applying the 100-year Global Warming Potential factor for nitrous oxide (which is 298) to the central estimates of the social cost of carbon dioxide for each future year. The source document for this information is: The GAO source document is cited as: U.S. Government Accountability Office, Report to Congressional Requesters, Social Cost of Carbon, Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis (GAO-20-254), June 2020.

$ = U.S. Dollars; mt = metric tons; SC-N_2O = Social Cost of Nitrous Oxide

Table I.6.24. Estimated Social Cost of Life Cycle GHG Emissions for Electricity Generation Technologies, by Life Cycle Phase - Based on Projected Average Annual Lifetime Electricity Production (Prior Administration Values, 2020, 3% Discount Rates)

Electricity Power Technology	Total Life Cycle Social Cost of CO_2 Emissions, $	Total Life Cycle Social Cost of CH_4 Emissions, $	Total Life Cycle Social Cost of N_2O Emissions, $	Total Life Cycle Social Cost of GHG Emissions, $
No Action Alternative - Coal (Supercritical pulverized); assumed 30-years remaining life for consistency	**$2,801,324,159**	**$4,199,125**	**$14,494,007**	**$2,820,017,291**
Alternative A - Natural Gas - CCs (30-year Life Cycle)	**$849,687,925**	**$116,413,206**	**$5,326,501**	**$971,427,632**
Alternative B - Natural Gas - CTs (30-year Life Cycle)	**$245,017,628**	**$36,253,719**	**$1,626,778**	**$282,898,649**
Alternative C - Solar (20-year Life Cycle, prorated to 30-years)	$121,424,675	$14,023	$1,216	$121,439,914
Alternative C - Li-Ion Battery Storage (20-year Life Cycle, prorated to 30-years)	$13,738,484	$1,439	$136	$13,740,059
Alternative C Total Life Cycle Social Cost of GHG Emissions, $	**$135,163,159**	**$15,462**	**$1,353**	**$135,179,973**

Table I.6.255. TVA System-Wide Estimated 20-Year Life Cycle CO_2 Emissions Compared to the No Action Alternative, by Life Cycle Phase

Electric Power Technology	One-Time Upstream CO_2 Emissions, tons	Cumulative Combustion CO_2 Emissions, tons	Cumulative Non-Combustion CO_2 Emissions, tons	One-Time Downstream CO_2 Emissions, tons	Life Cycle CO_2 Emissions, tons	Total CO_2 Emissions, tons
Alternative A Total						**-134,993,818**
Coal		-232,577,737	-1,099,817			**-233,677,554**
Natural Gas - Combined Cycle	184,802	63,574,149	13,015,659	4,620		**76,779,230**
Natural Gas - Simple Cycle		19,208,658	2,554,129			**21,762,787**
Hydroelectric		0	-6			**-6**
Nuclear		0	0			**0**
Wind & Solar		0	NR			**0**
Battery Storage (Generation)		0	NR			**0**
Pumped Hydro (Generation)		0	5,276			**5,276**
Market Purchases		2,017	134,430			**136,447**
Alternative B Total						**-117,072,024**
Coal		-225,747,170	-1,068,563			**-226,815,733**
Natural Gas - Combined Cycle		49,041,105	8,622,152			**57,663,257**
Natural Gas - Simple Cycle	6,273	45,387,831	6,000,899	134		**51,395,138**
Hydroelectric		0	0			**0**
Nuclear		0	0			**0**
Wind & Solar		0	NR			**0**
Battery Storage (Generation)		0	NR			**0**
Pumped Hydro (Generation)		0	6,838			**6,838**
Market Purchases		16,849	661,627			**678,477**
Alternative C Total						**-155,559,077**
Coal		-229,623,435	-1,086,693			**-230,710,129**
Natural Gas - Combined Cycle		24,871,332	4,504,314			**29,375,646**
Natural Gas - Simple Cycle		30,261,683	4,036,059			**34,297,743**
Hydroelectric		0	0			**0**
Nuclear		0	0			**0**
Wind & Solar		0	NR		9,269,059	**9,269,059**
Battery Storage (Generation)	1,723,466	0	NR	186,025		**1,909,491**
Pumped Hydro (Generation)		0	1,400			**1,400**
Market Purchases		11,603	286,110			**297,714**

Table I.6.266. TVA System-Wide Estimated 20-Year Life Cycle CH_4 Emissions Compared to the No Action Alternative, by Life Cycle Phase

Electric Power Technology	One-Time Upstream CH_4 Emissions, tons	Cumulative Combustion CH_4 Emissions, tons	Cumulative Non-Combustion CH_4 Emissions, tons	One-Time Downstream CH_4 Emissions, tons	Life Cycle CH_4 Emissions, tons	Natural Gas Related Methane Life Cycle Leakage, tons	Total CH_4 Emissions, tons
Alternative A Total							**-57,024**
Coal		-2.07E-03	-58,439				**-58,439**
Natural Gas - Combined Cycle	0.7	5.22E-03	1,172	0.02		2.19E-01	**1,172**
Natural Gas - Simple Cycle		8.59E-04	229.9			6.06E-02	**230**
Hydroelectric		0	0				**0**
Nuclear		0	0				**0**
Wind & Solar		0	NR				**0**
Battery Storage (Generation)		0	NR				**0**
Pumped Hydro (Generation)		0	4.75E-01				**0**
Market Purchases		4.52E-05	12.10			3.19E-03	**12**
Alternative B Total							**-55,401**
Coal		-2.01E-03	-56,778				**-56,778**
Natural Gas - Combined Cycle		3.46E-03	776			1.45E-01	**776**
Natural Gas - Simple Cycle	0.02	2.02E-03	540	4.84E-04		1.42E-01	**540**
Hydroelectric		0	0				**0**
Nuclear		0	0				**0**
Wind & Solar		0	NR				**0**
Battery Storage (Generation)		0	NR				**0**
Pumped Hydro (Generation)		0	6.15E-01				**1**
Market Purchases		2.23E-04	59.6			1.57E-02	**60**
Alternative C Total							**-56,906**
Coal		-2.05E-03	-57,741				**-57,741**
Natural Gas - Combined Cycle		1.81E-03	405.4			7.56E-02	**406**
Natural Gas - Simple Cycle		1.36E-03	363.3			9.58E-02	**363**
Hydroelectric		0	0				**0**
Nuclear		0	0				**0**
Wind & Solar		0	NR		33		**33**
Battery Storage (Generation)	6	0	NR	0.7			**7**
Pumped Hydro (Generation)		0	1.26E-01				**0**
Market Purchases		9.63E-05	26			6.79E-03	**26**

Table I.6.277. TVA System-Wide Estimated 20-Year Life Cycle N_2O Emissions Compared to the No Action Alternative, by Life Cycle Phase

Electric Power Technology	One-Time Upstream N_2O Emissions, tons	Cumulative Combustion N_2O Emissions, tons	Cumulative Non-Combustion N_2O Emissions, tons	One-Time Downstream N_2O Emissions, tons	Life Cycle N_2O Emissions, tons	Total N_2O Emissions, tons
Alternative A Total						**-10,362**
Coal		-3.26E-03	-10,519			**-10,519**
Natural Gas - Combined Cycle	0.006	1.82E-03	130.2	1.55E-04		**130**
Natural Gas - Simple Cycle		2.99E-04	25.54			**26**
Hydroelectric		0	-5.52E-05			**0**
Nuclear		0	0			**0**
Wind & Solar		0	NR			**0**
Battery Storage (Generation)		0	NR			**0**
Pumped Hydro (Generation)		0	5.28E-02			**0**
Market Purchases		1.57E-05	1.344			**1**
Alternative B Total						**-10,067**
Coal		-3.17E-03	-10,220			**-10,220**
Natural Gas - Combined Cycle		1.21E-03	86.2			**86**
Natural Gas - Simple Cycle	2.11E-04	7.03E-04	60.0	4.51E-06		**60**
Hydroelectric		0	-4.20E-05			**0**
Nuclear		0	0			**0**
Wind & Solar		0	NR			**0**
Battery Storage (Generation)		0	NR			**0**
Pumped Hydro (Generation)		0	6.84E-02			**0**
Market Purchases		7.75E-05	6.62			**7**
Alternative C Total						**-10,305**
Coal		-3.22E-03	-10,393			**-10,393**
Natural Gas - Combined Cycle		6.30E-04	45.05			**45**
Natural Gas - Simple Cycle		4.73E-04	40.36			**40**
Hydroelectric		0	3.98E-05			**0**
Nuclear		0	0			**0**
Wind & Solar		0	NR		0.5	**0**
Battery Storage (Generation)	0.1	0	NR	0.006		**0**
Pumped Hydro (Generation)		0	1.40E-02			**0**
Market Purchases		3.35E-05	2.861			**3**

Table I.6.288. TVA System-Wide Estimated 20-Year Life Cycle CO_2 Costs, Biden Administration, Compared to the No Action Alternative, by Life Cycle Phase (Biden Administration EO 13990 Interim Rates, 3% Discount Rates)

Electric Power Technology	One-Time Upstream CO_2 Cost	Yearly Ongoing Combustion and Non-Combustion CO2 Cost									
	2026	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Alternative A	10,764,668	0	0	0	0	-199,434,119	-257,169,541	-429,106,690	-482,491,449	-500,908,157	-647,159,156
Alternative B	365,425	0	0	0	0	-118,044,925	-168,401,564	-337,367,870	-408,343,060	-454,253,029	-599,533,601
Alternative C	829,284,390	0	0	0	0	-327,812,186	-379,592,416	-548,919,108	-609,630,037	-631,226,313	-759,966,096

Yearly Ongoing Combustion and Non-Combustion CO2 Cost										Downstream CO_2 Cost	Total Cost (Nominal $)
2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2057	
-712,486,609	-715,056,462	-792,196,591	-853,518,536	-891,101,899	-922,721,702	-955,886,340	-1,002,590,005	-1,040,461,919	-1,057,464,087	802,526	**-11,448,186,067**
-654,166,520	-661,502,344	-709,939,107	-751,082,210	-771,855,580	-806,981,743	-826,606,247	-870,047,270	-902,457,176	-922,961,442	23,351	**-9,963,154,911**
-812,655,101	-827,912,281	-910,956,598	-1,007,718,648	-1,054,207,793	-1,093,268,565	-1,129,105,329	-1,188,146,241	-1,235,530,274	-1,255,945,547	101,883,394	**-12,841,424,749**

Table I.6.29. TVA System-Wide Estimated 20-Year Life Cycle CH_4 Costs, Biden Administration, Compared to the No Action Alternative, by Life Cycle Phase (Biden Administration EO 13990 Interim Rates, 3% Discount Rates)

Electric Power Technology	One-Time Upstream CH_4 Cost	Yearly Combined Ongoing Combustion and Non-Combustion CH_4 Cost and Leakage Cost									
	2026	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Alternative A	1,224	0	0	0	0	-2,294,850	-2,927,754	-5,162,895	-6,339,296	-6,804,598	-9,249,104
Alternative B	42	0	0	0	0	-1,687,271	-2,364,267	-4,677,537	-5,925,604	-6,387,368	-8,880,219
Alternative C	94,286	0	0	0	0	-2,212,100	-2,726,192	-4,914,359	-6,137,840	-6,600,557	-9,035,449

Yearly Combined Ongoing Combustion and Non-Combustion CH_4 Cost and Leakage Cost										One-Time Downstream CH_4 Cost	Total Cost (Nominal $)
2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2057	
-10,087,428	-10,649,512	-11,085,808	-12,049,816	-12,311,416	-13,237,131	-14,107,881	-14,556,041	-15,480,120	-15,658,316	107	**-162,000,636**
-9,635,110	-10,515,604	-11,087,292	-12,041,178	-12,299,470	-13,225,874	-14,094,252	-14,541,548	-15,464,277	-15,644,646	3	**-158,471,476**
-9,816,227	-10,619,618	-11,167,747	-12,148,594	-12,416,568	-13,350,392	-14,228,071	-14,678,931	-15,609,783	-15,790,942	36,434	**-161,322,649**

Table I.6.30. TVA System-Wide Estimated 20-Year Life Cycle N_2O Costs, Biden Administration, Compared to the No Action Alternative, by Life Cycle Phase (Biden Administration EO 13990 Interim Rates, 3% Discount Rates)

Electric Power Technology	One-Time Upstream N_2O Cost	Yearly Ongoing Combustion and Non-Combustion N_2O Cost									
	2026	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Alternative A	133	0	0	0	0	-4,862,404	-6,156,528	-10,857,650	-13,248,547	-14,230,324	-19,219,209
Alternative B	5	0	0	0	0	-3,576,221	-4,972,905	-9,838,527	-12,381,019	-13,346,308	-18,438,951
Alternative C	10,254	0	0	0	0	-4,630,773	-5,669,478	-10,270,952	-12,759,341	-13,734,455	-18,710,283

Yearly Ongoing Combustion and Non-Combustion N_2O Cost										Downstream N_2O Cost	Total Cost (Nominal $)
2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2057	
-20,960,216	-22,004,123	-22,891,429	-24,745,884	-25,282,217	-27,052,808	-27,679,214	-29,615,463	-30,284,788	-31,728,578	0	**-330,819,248**
-20,007,876	-21,715,768	-22,893,311	-24,735,045	-25,267,226	-27,038,749	-27,662,873	-29,597,443	-30,265,847	-31,711,652	0	**-323,449,715**
-20,334,444	-21,877,114	-22,994,873	-24,869,935	-25,414,275	-27,194,363	-27,823,421	-29,768,371	-30,439,918	-31,892,920	1,001	**-328,373,661**

Table I.6.31. TVA System-Wide Estimated 20-Year Life Cycle CO_2 Costs, Prior Administration, Compared to the No Action Alternative, by Life Cycle Phase (Estimates Used in Conducting Regulatory Impact Analyses under Prior EPA Administration, 2020 (3% Discount Rate))

Electric Power Technology	One-Time Upstream CO_2 Cost	Yearly Ongoing Combustion and Non-Combustion CO2 Cost									
	2026	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Alternative A	1,293,613	0	0	0	0	-22,700,001	-28,219,320	-45,406,031	-49,246,554	-49,328,204	-61,504,756
Alternative B	43,914	0	0	0	0	-13,436,116	-18,478,773	-35,698,665	-41,678,435	-44,733,721	-56,978,515
Alternative C	99,656,869	0	0	0	0	-37,312,256	-41,652,832	-58,084,011	-62,223,235	-62,161,615	-72,225,710

Yearly Ongoing Combustion and Non-Combustion CO2 Cost										Downstream CO_2 Cost	Total Cost (Nominal $)
2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2057	
-74,702,081	-72,387,833	-77,451,025	-79,438,805	-80,148,978	-80,219,671	-80,341,896	-81,483,309	-81,782,888	-90,453,357	55,441	**-1,053,465,655**
-68,587,395	-66,966,350	-69,408,922	-69,904,836	-69,423,526	-70,157,459	-69,475,952	-70,711,188	-70,935,373	-78,948,270	1,613	**-915,477,970**
-85,204,446	-83,812,649	-89,061,886	-93,790,540	-94,819,322	-95,046,691	-94,900,889	-96,563,986	-97,115,745	-107,431,063	11,964,811	**-1,159,785,196**

Table I.6.32. TVA System-Wide Estimated 20-Year Life Cycle CH_4 Costs, Prior Administration, Compared to the No Action Alternative, by Life Cycle Phase (Estimates Used in Conducting Regulatory Impact Analyses under Prior EPA Administration, 2020 (3% Discount Rate))

Electric Power Technology	One-Time Upstream CH_4 Cost	Yearly Combined Ongoing Combustion and Non-Combustion CH_4 Cost and Leakage Cost									
	2026	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Alternative A	132	0	0	0	0	-249,282	-303,014	-537,054	-629,252	-678,066	-880,699
Alternative B	4	0	0	0	0	-183,283	-244,694	-486,566	-588,188	-636,490	-845,574
Alternative C	10,177	0	0	0	0	-240,293	-282,153	-511,201	-609,255	-657,734	-860,355

Yearly Combined Ongoing Combustion and Non-Combustion CH_4 Cost and Leakage Cost										One-Time Downstream CH_4 Cost	Total Cost (Nominal $)
2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2057	
-963,228	-972,922	-1,014,639	-1,056,370	-1,080,312	-1,113,717	-1,139,623	-1,175,496	-1,201,254	-1,213,851	6	**-14,208,640**
-920,037	-960,689	-1,014,774	-1,055,612	-1,079,264	-1,112,770	-1,138,522	-1,174,325	-1,200,025	-1,212,791	0	**-13,853,600**
-937,331	-970,191	-1,022,138	-1,065,029	-1,089,540	-1,123,246	-1,149,332	-1,185,420	-1,211,316	-1,224,132	2,053	**-14,126,435**

Table I.6.33. TVA System-Wide Estimated 20-Year Life Cycle N_2O Costs, Prior Administration, Compared to the No Action Alternative, by Life Cycle Phase (Estimates Used in Conducting Regulatory Impact Analyses under Prior EPA Administration, 2020 (3% Discount Rate))

Electric Power Technology	One-Time Upstream N_2O Cost	Yearly Ongoing Combustion and Non-Combustion N_2O Cost									
	2026	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Alternative A	13	0	0	0	0	-462,527	-555,166	-972,199	-1,126,536	-1,201,120	-1,542,952
Alternative B	0	0	0	0	0	-340,182	-448,432	-880,946	-1,052,769	-1,126,504	-1,480,311
Alternative C	982	0	0	0	0	-440,494	-511,246	-919,665	-1,084,938	-1,159,266	-1,502,094

Yearly Ongoing Combustion and Non-Combustion N_2O Cost										Downstream N_2O Cost	Total Cost (Nominal $)
2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2057	
-1,669,847	-1,669,772	-1,723,318	-1,776,812	-1,800,422	-1,839,689	-1,866,350	-1,909,044	-1,956,442	-1,982,408	0	**-24,054,590**
-1,593,976	-1,647,890	-1,723,460	-1,776,034	-1,799,355	-1,838,733	-1,865,248	-1,907,882	-1,955,218	-1,981,350	0	**-23,418,290**
-1,619,993	-1,660,134	-1,731,106	-1,785,720	-1,809,827	-1,849,315	-1,876,073	-1,918,900	-1,966,464	-1,992,676	96	**-23,826,833**

Appendix J – CUF Terrestrial Plant Communities and Botanical Resources Survey

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THE TENNESSEE VALLEY AUTHORITY

Cumberland Fossil Comprehensive Site Survey

Terrestrial Plant Communities and Botanical Resources Survey Report

09/17/2021

Descriptions of Individual Plant Communities on the Cumberland Fossil Property

Terrestrial Ecology and T&E Plants

September 2021

Much of the Cumberland Fossil Plant (CUF) site is forested with deciduous, mixed evergreen deciduous, and evergreen forests. A majority of these forests have experienced extensive previous disturbance and are degraded by non-native species infestations. A small percentage of deciduous forested stands represent mature, relatively undisturbed plant communities populated primarily by native plant species. Heavily disturbed developed areas, pastures/hayfields, and transmission line right-of-way (ROW) account for a majority of the herbaceous vegetation present on-site. The vast majority of herbaceous vegetation at CUF is dominated by primarily by non-native plant species and possesses little conservation value. Small sections of transmission line ROW do support a flora indicative of a native grassland and support a number of native species.

Field surveys of CUF, along with interpretation of aerial photos, resulted in 38 discrete vegetation polygons. The vast majority of these polygons have no potential to support state or federally listed plant species, or unique plant communities, and would not require additional field surveys if a project is proposed there. Three polygons (13, 21, and 22) do support state-listed plants; these areas are identified in the text below and within the associated GIS layer. Brief summaries of the vegetation composition and structure within each polygon are listed below. The full site survey is good for ten years, unless new species are listed that could be found on the CUF site.

Botany 001

Mixed evergreen forest with overstory tree diameter at breast height (DBH) ranging from 12” to 24”+. Common tree species include American beech (*Fagus grandifolia*), northern red oak (*Quercus rubra*), slippery elm (*Ulmus rubra*), southern red oak (*Quercus falcata*), sugar maple (*Acer saccharum*), sweetgum (*Liquidambar styraciflua*) along with the evergreen species eastern red cedar (*Juniperus virginiana*), loblolly pine (*Pinus taeda*), and shortleaf pine (*Pinus echinata*). Christmas fern (*Polystichum acrostichoides*) and common greenbrier (*Smilax rotundifolia*) are the most common plants in the herb layer. No plants of conservation concern were observed.

Botany 002

Deciduous forest with average DBH ranging from 6 to 18”. Common overstory trees include American beech, black cherry (*Prunus serotina*), northern red oak, pignut hickory (*Carya glabra*), sassafras (*Sassafras albidum*), shagbark hickory (*Carya ovata*), slippery elm, southern red oak, sugar maple, tulip poplar (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), and white oak (*Quercus alba*) with American hophornbeam (*Ostrya virginiana*), common greenbrier, coralberry (*Symphoricarpos orbiculatus*), eastern redbud (C*ercis canadensis*), flowering dogwood (*Cornus florida*), northern spicebush (*Lindera benzoin*), pawpaw (*Asimina triloba*), Virginia creeper (*Parthenocissus quinquefolia*), and winged elm (*Ulmus alata*) in the understory. Broach beechfern (*Phegopteris hexagonoptera*), spotted wintergreen (*Chimaphila maculata*), Christmas fern, ebony spleenwort (*Asplenium platyneuron*), Indian tobacco (*Lobelia inflata*), Japanese stiltgrass (*Microstegium vimineum*), licorice bedstraw (*Galium circaezans*), and wild comfrey (*Andersonglossum virginianum*) are common in the herb layer. This area has no potential to support state or federally listed plants.

Botany 003

Vegetation structure and species composition similar to Botany 002.

Botany 004

Disturbed field with the invasive plants Johnson grass (*Sorghum halepense*) and sericea lespedeza (*Lespedeza cuneata*) along with other common native and non-native herbaceous species. This area has no potential to support state or federally listed plants.

Botany 005

Deciduous limestone forest with average DBH ranging from 6 to 18”. Common overstory trees include American beech, black cherry, black gum (*Nyssa sylvatica*), chinkapin oak (*Quercus muehlenbergii*), common persimmon (*Diospyros virginiana*), mockernut hickory (*Carya tomentosa*), sugar maple, sweetgum, tulip poplar, white ash, and white oak with American hophornbeam, common greenbrier, coralberry, northern spicebush, pawpaw, poison ivy (*Toxicodendron radicans*), Virginia creeper, and winged elm in the understory. Canadian black snakeroot (*Sanicula canadensis*), Carolina elephant’s-foot (*Elephantopus carolinianus*), Christmas fern, cranefly orchid (*Tipularia discolor*), ebony spleenwort, elephant’s-foot (*Elephantopus tomentosus*), Japanese honeysuckle (*Lonicera japonica*), Japanese stiltgrass, jumpseed (*Persicaria virginiana*), southern grape fern (*Sceptridium biternatum*), sweet Joe-Pye-weed (*Eutrochium purpureum*), and wild comfrey are common in the diverse herb layer. This area has no potential to support state or federally listed plants.

Botany 006

Disturbed field with common species including Johnson grass, sericea lespedeza and other common native and non-native herbaceous species. This area has no potential to support state or federally listed plants.

Botany 007

Vegetation is similar to Botany 005.

Botany 008

Early successional vegetation in transmission line right-of-way consisting mainly of annual ragweed (*Ambrosia artemisiifolia*), beefsteak plant (*Perilla frutescens*), brown eyed Susan (*Rudbeckia triloba*), late-flowering thoroughwort (*Eupatorium serotinum*), gray goldenrod (*Solidago nemoralis*), purple passionflower (*Passiflora incarnata*), sawtooth blackberry (*Rubus pensilvanicus*), sericea lespedeza, wild bergamot (*Monarda fistulosa*), and wrinkle leaf goldenrod (*Solidago rugosa* var. *aspera*). No plants of conservation concern were observed.

Botany 009

Dry deciduous forest with average DBH ranging from 6 to 24”. Common overstory trees include American beech, black gum, northern red oak, scarlet oak, sassafras, southern red oak, sugar maple, sweetgum, tulip poplar, white ash, and white oak with American hophornbeam, common greenbrier, flowering dogwood, Virginia creeper, and winged elm in the understory. American dittany (*Cunila origanoides*), American hog peanut (*Amphicarpaea bracteata*), Bosc’s panic grass (*Dichanthelium boscii*), Christmas fern, nakedflower ticktrefoil (*Hylodesmum nudiflorum*), and wild comfrey are common in the herb layer. This area has no potential to support state or federally listed plants.

Botany 010

Mesic deciduous forest with average DBH ranging from 6 to 24”. Common overstory trees include American beech, American sycamore (*Platanus occidentalis*), black gum, northern red oak, sassafras, southern red oak, sugar maple, sweetgum, tulip poplar, white ash, and white oak with American hophornbeam, common greenbrier, coralberry, flowering dogwood, ironwood, northern spicebush, and pawpaw in the understory. Bottlebrush grass (*Elymus hystrix*), bear’s foot (*Smallanthus uvedalia*), Carolina elephant’s-foot, Christmas fern, Japanese stiltgrass, jumpseed, richweed (*Collinsonia canadensis*), southern long-awned woodgrass (*Brachyelytrum erectum*), and wild comfrey are common in the herb layer. This area has no potential to support state or federally listed plants.

Botany 011

Deciduous forest with overstory trees diameter ranging from 3” to 24” DBH. Common tree species include American basswood (*Tilia americana*), American beech, black cherry, black walnut, mockernut hickory, shagbark hickory, sassafras, sugar maple, and white oak in the overstory with American hophornbeam, coralberry, eastern redbud, flowering dogwood,

hackberry, pawpaw, and Virginia creeper in the understory. Canadian black snakeroot and jumpseed are common in the herb layer. No plants of conservation concern were observed.

Botany 012

Deciduous forest with overstory trees diameter ranging from 6” to 18” DBH. Common tree species include American basswood, American beech, black cherry, black walnut (*Juglans nigra*), green ash, mockernut hickory, southern hackberry, sugar maple, and sweetgum in the overstory with American hophornbeam, coralberry, eastern redbud, flowering dogwood, and pawpaw and a plethora of ash seedlings in the understory. Carolina elephant’s-foot, ebony spleenwort, Japanese stiltgrass, and jumpseed are common in the herb layer. No plants of conservation concern were observed.

Botany 013

Disturbed deciduous bottomland forest with overstory trees ranging from less than 6” to 18”+ DBH. Common tree species include American basswood, American sycamore, black walnut, Osage orange (*Maclura pomifera*), slippery elm, southern hackberry (*Celtis laevigata*), sugar maple, and sweetgum in the overstory with bear’s foot, common greenbrier, Chinese privet (*Ligustrum sinense*), coralberry, ironwood, multiflora rose, northern spicebush, pawpaw, river cane (*Arundinaria gigantea*), winged elm with many overstory tree saplings in the understory. Broadleaf arrowhead (*Sagittaria latifolia*), Canadian honewort (*Cryptotaenia canadensis*), cardinal flower (*Lobelia cardinali*s), Carolina elephant’s-foot, Christmas fern, fox sedge (*Carex vulpinoidea*), Frank’s sedge (*Carex frankii*), Japanese stiltgrass, jumpseed, smallspike false nettle (*Boehmeria cylindrica*), sweet woodreed (*Cinna arundinacea*), Virginia spiderwort (*Tradescantia virginiana*), and wingstem (*Verbesina alternifolia*) are common in the dense herb layer. Ten trees of the state-listed plant common prickly ash (*Zanthoxylum americanum*) are found in this wetland.

Botany 014

Deciduous bottomland forest with overstory trees ranging from less than 6” to 24”+ DBH. Common tree species include American sycamore, green ash (*Fraxinus pennsylvanica*), southern hackberry, swamp chestnut oak (*Quercus michauxii*), sweetgum, and water locust (*Gleditsia aquatica*) in the overstory with common greenbrier, ironwood, pawpaw, possum haw (*Ilex decidua*), river cane, rough leaf dogwood (*Cornus drummondii*), and Virginia creeper in the understory. American hog peanut, broadleaf woodoats (*Chasmanthium latifolium*), Carolina spiderlily (*Hymenocallis occidentalis*), creeping jenny (*Lysimachia nummularia*), crossvine (*Bignonia capreolata*), ditch stonecrop (*Penthorum sedoides*), greater bladder sedge (*Carex intumescens*), green dragon (*Arisaema dracontium*), Japanese stiltgrass, jumpseed, sharpwing monkey flower (*Mimulus alatus*), small spike false nettle, squarrose sedge (*Carex squarrosa*), and Virginia spiderwort are common in the dense herb layer. No plants of conservation concern were observed in this wetland community.

Botany 015

Deciduous bottomland forest with overstory trees ranging from less than 6” to 18” DBH. Common tree species include American sycamore, bald cypress (*Taxodium distichum*), black willow (*Salix nigra*), box elder (*Acer negundo*), green ash, red maple (*Acer rubrum*), and silver maple (*Acer saccharinum*) in the overstory with common buttonbush (*Cephalanthus occidentalis*) and poison ivy in the understory. Broadleaf woodoats, blue mistflower (*Conoclinium coelestinum*), camphor weed (*Pluchea camphorata*), common sneezeweed (*Helenium autumnale*), creeping jenny, late flowering thoroughwort, redtop panic grass (*Coleataenia rigidula*), and squarrose sedge are common in the herb layer. No plants of conservation concern were observed in this wetland community.

Botany 016

Disturbed field with common species including Johnson grass, sericea lespedeza and other common native and non-native herbaceous species. Thickets of honey locust (*Gleditsia triacanthos*) present. Fragmented forest strips supporting species seen in other deciduous forest stands on-site are found across this polygon.

Botany 017

Deciduous forest with overstory trees ranging from 6” to 21” DBH. Common tree species include American beech, chinkapin oak, northern red oak, pignut hickory, shagbark hickory, sugar maple, sweetgum, tulip poplar, white ash, and white oak in the overstory with American hophornbeam, flowering dogwood, pawpaw, sourwood (*Oxydendrum arboretum*), winged elm and a dense cover of overstory tree saplings in the midstory. Naked-flowered tick trefoil and wild comfrey are present in the herb layer. No plants of conservation concern were observed.

Botany 018

Vegetation is similar to Botany 008.

Botany 019

Dense deciduous forest with overstory trees ranging from 6” to 24” DBH. Common tree species include American beech, chinkapin oak, mockernut hickory, northern red oak, shagbark hickory, sugar maple, sweetgum, tulip poplar, white ash, and white oak in the overstory with flowering dogwood, ironwood, sourwood, winged elm and a dense cover of overstory tree saplings in the midstory. No plants of conservation concern were observed.

Botany 020

Deciduous forest with overstory trees ranging from 4" to 24" DBH. Common tree species include American sycamore, Biltmore white ash (*Fraxinus biltmoreana*), box elder, chinkapin oak, honey

locust, mockernut hickory, pignut hickory, sassafras, shagbark hickory, sugar maple, sweetgum, tulip poplar, white oak, and winged elm in the overstory with box elder, Chinese privet, coralberry, Small's hackberry (*Celtis smallii*), eastern red cedar, flowering dogwood, pawpaw, poison ivy, Virginia creeper in the understory. Canadian black snakeroot, Carolina elephant's-foot, Christmas fern, crossvine, hairy bedstraw (*Galium pilosum*), Japanese honeysuckle, Japanese stiltgrass, jumpseed, sweet woodreed, white snakeroot (*Ageratina altissima*), and white vervain (*Verbena urticifolia*), and winter creeper (*Euonymus hederaceus*) are common in the herb layer. No plants of conservation concern were observed.

Botany 021

Early successional vegetation in transmission line right-of-way consisting mainly of annual ragweed (*Ambrosia artemisiifolia*), beaked panic grass (*Coleataenia anceps*), blackeyed Susan (*Rudbeckia hirta*), clustered mountain mint (*Pycnanthemum muticum*), flat-top goldenrod (*Euthamia graminifolia*), golden tickseed (*Coreopsis tripteris*), gray goldenrod, greater tickseed (*Coreopsis major*), hairy sunflower (*Helianthus hirsutus*), hyssopleaf thoroughwort (*Eupatorium hyssopifolium*), little bluestem (*Schizachyrium scoparium*), Maryland meadow beauty (*Rhexia mariana* var. *mariana*), pink fuzzy bean (*Strophostyles umbellata*), poorjoe (*Diodia teres*), purple passionflower, roundleaf thoroughwort (*Eupatorium rotundifolium*), wild bergamot, wholeleaf rosinweed (*Silphium integrifolium*), and wrinkleleaf goldenrod. Thirty state endangered Texas goldentop (*Euthamia gymnospermoides*) plants are found in the old access road in the ROW between structures 159-160.

Botany 022

Dry deciduous forest with average DBH ranging from 6 to 24". Common overstory trees include American beech, bitternut hickory (*Carya cordiformis*), black gum, sassafras, sugar maple, sweetgum, tulip poplar, white ash, and white oak with American hophornbeam, poison ivy, Virginia creeper, and winged elm in the understory. American dittany, American hog peanut, Christmas fern, crossvine, Japanese stiltgrass, jumpseed, nakedflower ticktrefoil, and wild comfrey are common in the herb layer. Seven American ginseng (*Panax quinquefolius*), which has a state status of special concern-commercially exploited, are found in the area. This area has no federally listed plants.

Botany 023

Deciduous forest with average DBH of 12". Common woody species include sugar maple, shagbark hickory, chinkapin oak, sugarberry, redbud, and white oak. Herb layer species include crane-fly orchid, hay-scented fern (*Dennstaedtia punctilobula*), sassafras, smooth cat-briar smilax glauca. Japanese stilt grass sporadic in this polygon.

Botany 024

Riparian, deciduous forest. Open spacing, becoming denser downslope. Average DBH of 10” with some larger trees approaching 24”. Sugar maple, silver maple, tulip poplar, sweetgum, green ash, shagbark hickory, pignut hickory, and American hornbeam common. Very little herb/shrub diversity, but sassafras, Christmas fern, and Japanese stilt grass prevalent throughout.

Botany 025

Deciduous forest. Average DBH of 12 inches with exterior of forest having smaller, weedier tree species. Sugar maple, shagbark hickory, mockernut hickory, red oak, white oak, American beech, and American hornbeam common. Little herb/shrub diversity; smooth cat-briar, highbush blueberry, Christmas fern present.

Botany 026

Open, disturbed tract with very little native vegetation. Relatively recently mowed, Johnson grass and broom-sedge (*Andropogon virginicus*) dominate these areas with scattered saplings of trees from the surrounding forest found throughout.

Botany 027

Dry upland, deciduous forest. Common trees include American beech, mockernut hickory, shagbark hickory, pignut hickory, tulip poplar, red maple, sugar maple, white oak, chinkapin oak, and American holly (*Ilex opaca*). Even-age stand, DBH averaging around 12”. Very little herb and shrub diversity, smooth cat-briar and Japanese stilt grass present.

Botany 028

Dry, upland deciduous forest. Rockier adjacent to the transmission line and at higher elevations. Average tree DBH is 12”. Common trees include white oak, red oak, chinkapin oak, blackjack oak, shagbark hickory, American beech, and American hornbeam. Well-developed herb/shrub layer with smooth cat-briar, blackberry, longleaf wood oats (C*hasmanthium sessiliflorum*), sassafras, and spicebush.

Botany 029

Extremely disturbed mixed evergreen deciduous forest. Young American beech and red maple trees dominate; average DBH about 6”. Herb and shrub layer completely dominated by Japanese stilt grass, little overall diversity. Area likely recently logged.

Botany 030

Dry, open, rocky deciduous forest with average DBH of about 14”. Some trees over 20 inches in DBH. Common species include white oak, blackjack oak, southern red oak, sugar maple, shagbark hickory, mockernut hickory, pawpaw, spicebush, tulip poplar. Very rocky along slopes, large boulders found throughout.

Botany 031

Relatively young deciduous forest surrounding lake. Ruderal, average tree DBH to 10”. Sugar maple, sweetgum, and boxelder common. Relatively wet, eastern portion dominated by kudzu (*Pueraria montana* var. *lobata*). No plants of conservation concern observed in this area.

Botany 032

Ruderal open area. Limited woody vegetation, average DBH about 3 inches. Predominant herbs and shrubs include American pokeberry, Johnson grass, Chinese privet, purple passionflower, tall goldenrod (*Solidago altissima*), and Dallis grass (*Paspalum dilatatum*). No plants of conservation concern observed in this area

Botany 033

Vegetation is similar to Botany 032.

Botany 034

Vegetation is similar to Botany 032.

Botany 035

Ruderal, open area surrounding pond. Dominant vegetation primarily common reed (*Phragmites australis*) in and around pond. Adjacent weedy species include Johnson grass, Small’s hackberry, redbud, eastern-red cedar, white ash. No plants of conservation concern observed in this area

Botany 036

Bottomland deciduous forest. Average DBH 12” with some trees at higher elevations approaching 24” DBH. Osage orange, boxelder, sugar maple, white oak, Carolina buckthorn, Chinese privet, American beech, black walnut, grape, poison ivy, and sweetgum are common. Ruderal, vegetation thick.

Botany 037

Dry, upland deciduous forest with overstory trees averaging about 16” DBH. Common species include sugar maple, white oak, Carolina buckthorn, Chinese privet, American beech, black walnut, grape, poison ivy, sweetgum.

Botany 038

Vegetation is similar to Botany 37

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Appendix K – USFWS Letter of Concurrence

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Tennessee Ecological Services Field Office
446 Neal Street
Cookeville, Tennessee 38501
(931) 528-6481

July 20, 2022

Mr. Douglas White
Manager
Biological Compliance
Tennessee Valley Authority
400 W Summit Hill Dr.
Knoxville, Tennessee 3

FWS # 2022-0036113 & 2022-0036130. Tennessee Valley Authority - Proposed Cumberland Fossil Plant Retirement in Cumberland City, Stewart County, Tennessee.

Dear Mr. White:

Thank you for your recent correspondence concerning the Tennessee Valley Authority's (TVA) proposed retirement and demolition of the existing Cumberland Fossil Plant (CUF) and new upgrades on the property in Cumberland City, Stewart County, Tennessee. To replace the lost generation capacity from one unit and to adapt to a changing generation portfolio, you are considering constructing and operating a Combined Cycle (CC) gas plant on the existing CUF reservation once demolition is complete. You also propose to construct a new switchyard at the CC plant site, modify existing transmission connections on the CC plant site, and install fiber-optic ground wire along approximately six miles of existing TVA transmission line in Cheatham and Davidson counties. You have requested informal section 7 consultation with our agency regarding the proposed actions at the CUF reservation site and the proposed transmission upgrades. You have requested our concurrence with your not likely to adversely affect determinations, and acknowledgement of your no effect determinations for federally listed species.

Your review of the TVA Regional Natural Heritage database and the U.S. Fish and Wildlife Service IPaC website indicated nineteen (19) species listed as endangered, threatened, proposed, candidate, or delisted and monitored under the Endangered Species Act are reported from Cheatham, Davidson, and Stewart counties, Tennessee. These species include five plants (Braun's rockcress, leafy prairie-clover, Price's potato-bean, Pyne's ground plum, and Short's bladderpod), seven mussels (Cumberland combshell, orangefoot pimpleback, pink mucket,

rabbitsfoot, ring pink, tan riffleshell, and yellow-blossom pearlymussel), one crayfish (Nashville crayfish), one bird (bald eagle), three mammals (gray bat, Indiana bat, and northern long-eared bat (NLEB)), one proposed reptile (alligator snapping turtle), and one candidate insect (monarch butterfly).

A comprehensive site survey was conducted by TVA biologists from June – August 2021 to determine whether suitable habitat for federally listed species occurred on the CUF reservation. Survey efforts did not reveal the presence of any Price's potato bean or any suitable habitat that would support this species, therefore, you have made a *no effect* determination for this species at the CUF reservation. Additionally, you have made a *no effect* determination for the pink mucket and rabbitsfoot mussels in the Cumberland River based on degraded habitat and no collections of these mussels from recent survey efforts. Extirpated or historical records of tan riffleshell, yellow-blossom pearlymussel, Cumberland Combshell, orangefoot pimpleback, pink mucket, and ring pink are known from the Harpeth River in Cheatham and Davidson counties. Based on no proposed impacts to the Harpeth River in association with the proposed transmission upgrades, you have made a *no effect* determination for these mussel species. Additionally, you have made a *no effect* determination for the Nashville crayfish based on no proposed impacts within the Mill Creek watershed.

A bald eagle nest was active from 2005-2009 near CUF, approximately 0.26 mile west of the CUF settling ponds between two TVA transmission line right-of-ways, suggesting habitat in this area is suitable for bald eagle nesting. The USFWS rare species database indicates that this nest no longer exists at the site. Additionally, no bald eagles or nests were observed during the 2021 field surveys despite a thorough search of the previous nesting area. Best management practices would be implemented along Wells Creek and the Cumberland River that help preserve foraging habitats for the bald eagle. You have indicated that the bald eagle would not be impacted by the proposed actions.

The federally listed Braun's rockcress, leafy prairie-clover, Price's potato-bean, Pyne's ground plum, and Short's bladderpod have been previously documented from Cheatham and Davidson counties, Tennessee, where the transmission upgrades would be located. However, the TVA Regional Natural Heritage database indicates that none of these species have been previously documented within five miles of the right-of-way where work would occur. Your correspondence indicates that a desktop review of the transmission line right-of-way and surrounding vicinity indicated that the specialized habitat required by these plant species is unlikely to occur in the proposed work areas. In addition, topographic maps and aerial photos indicate that no river bluffs or cedar glades occur within the potential action area. For this reason, you have determined that the proposed transmission upgrades are *not likely to adversely affect* Braun's rockcress, leafy prairie-clover, Price's potato-bean, Pyne's ground plum, and Short's bladderpod. However, given that the full scope of the transmission upgrades has not been finalized, TVA biologists cannot perform field surveys for federally listed plants at this time. As a conservation and avoidance measure, you have committed to conducting comprehensive surveys of the proposed work areas once the scope is finalized. In the event that TVA biologists do locate occupied habitat for federally listed plants, you would need to re-initiate section 7 consultation with our office.

Bat habitat assessments were conducted at the CUF reservation to determine if potential roosting habitat of the Indiana and NLEB existed. No caves or mines were observed on the CUF property. No evidence of roosting bats was observed on or under the bridge closest to the proposed demolition, and there was no evidence of bat use in the existing buildings on site. Some areas of suitable roost habitat for the Indiana bat and NLEB exists within the proposed CC plant site and new transmission construction areas. You propose to remove up to 35.36 acres of moderate to high quality summer bat roosting habitat on the CUF reservation between November 15 and March 31 to avoid possible direct impacts to the Indiana bat and NLEB. Prior to demolition, internal surveys of the buildings proposed for demolition would occur to ensure no colonies of bats have been established while buildings are inactive. The bridge near the site would also be examined prior to the start of demolition to ensure no evidence of bat use. Should bats be observed, avoidance and minimization measures (such as seasonal restrictions) would be put in place, and our agency would be contacted to ensure compliance.

Nine caves are known within three miles of the transmission upgrades in Cheatham and Davidson counties; however, no federally listed bat species are known from any of these caves. Although the majority of the transmission upgrades are proposed within the existing right-of-way, should existing access roads need to be upgraded or new access roads constructed, you have indicated that a conservative, worst-case estimate indicates that up to three (3) acres of suitable summer roosting bat habitat could be removed for these roads. The removal of suitable habitat for this portion of the project would occur between October 15 and March 31. As a conservation and avoidance measure, you have committed to conducting comprehensive field surveys of the proposed transmission upgrades and any associated access roads once the full scope of the transmission upgrades has been finalized. Should any previously unknown caves or other documented roosting sites be identified during field surveys, you would reinitiate section 7 consultation.

Based on best management practices being utilized around all water bodies to minimize impacts to hydrology and water quality, no known caves within the impact areas, and no occurrence records in the vicinity of the CUF reservation and transmission lines, you have made a *not likely to adversely affect* determination for the gray bat. You have determined that the proposed actions associated with the CUF retirement, CC plant construction, and transmission upgrades *may affect, and are likely to adversely affect* the Indiana bat and northern long-eared bat. Approximately 38.36 acres of "Take" for suitable bat habitat removal during the winter season will be used from TVA's 2018 programmatic consultation with USFWS for impacts of routine actions on federally listed bats.

Upon consideration of the provided information, and your commitment to conducting comprehensive surveys of the transmission upgrade routes once the scope is finalized, and re-coordinating with our office if occupied habitat for federally listed plants is observed, we concur with your determinations of *not likely to adversely affect* for Braun's rockcress, leafy prairie-clover, Price's potato-bean, Pyne's ground plum, and Short's bladderpod for the transmission upgrade. Based on protection of water bodies, no known caves within the impact areas, and no occurrence records in the vicinity of the CUF reservation and transmission lines, we also concur with your *not likely to adversely affect* determination for the gray bat.

We agree that your project design complies with the National Bald Eagle Management Guidelines, and we acknowledge the no effect determinations for the Price's potato-bean for proposed work at the CUF reservation and the Nashville crayfish, rabbitsfoot, tan riffleshell, yellow-blossom pearlymussel, Cumberland Combshell, orangefoot pimpleback, pink mucket, and ring pink throughout the proposed work areas.

In view of this, we believe that the requirements of section 7 of the Endangered Species Act (Act) have been fulfilled. Obligations under section 7 of the Act must be reconsidered if (1) new information reveals impacts of the action that may affect listed species or critical habitat in a manner not previously considered, (2) the action is subsequently modified to include activities which were not considered during this consultation, (3) new species are listed or critical habitat designated that might be affected by the action, or (4) the amount or extent of expected take of suitable bat habitat is exceeded.

Thank you for the opportunity to comment on this proposed action. We appreciate your efforts to avoid and minimize impacts to federally listed species. If you have any questions regarding the information which we have provided, please contact Robbie Sykes of my staff at 931/214-3215, or by email at *robbie_sykes@fws.gov*.

Sincerely,

Field Supervisor

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Tennessee Ecological Services Field Office
446 Neal Street
Cookeville, TN 38501-4027
Phone: (931) 528-6481 Fax: (931) 528-7075

In Reply Refer To: April 26, 2022
Project Code: 2022-0036113
Project Name: Cumberland Fossil Plant EIS - CUF site only

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Tennessee Ecological Services Field Office
446 Neal Street
Cookeville, TN 38501-4027
(931) 528-6481

Project Summary

Project Code: 2022-0036113
Event Code: None
Project Name: Cumberland Fossil Plant EIS - CUF site only
Project Type: Power Gen - Natural Gas
Project Description: In order to address the performance challenges that come with an aging Coal Fleet, the Tennessee Valley Authority (TVA) is proposing to retire and demolish the Cumberland Fossil Plant (CUF). To replace the lost generation capacity from one unit and to adapt to a changing generation portfolio, TVA is considering constructing and operating a Combined Cycle gas (CC) plant on the existing CUF Reservation. TVA also proposes to construct a new switchyard at the CC plant site, modify existing transmission connections on the CC plant site, and install fiber-optic ground wire along approximately 6 miles of existing TVA transmission line. Several activities associated with this project (including tree removal and building demolition) were addressed in TVA's programmatic consultation with the U.S. Fish and Wildlife Service on routine actions and federally listed bats in accordance with Endangered Species Act Section 7(a)(2), completed in April 2018.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@36.387018,-87.66544254408522,14z

Counties: Houston and Stewart counties, Tennessee

Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Gray Bat *Myotis grisescens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6329	Endangered
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Clams

NAME	STATUS
Rabbitsfoot *Quadrula cylindrica cylindrica* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5165	Threatened

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Prices Potato-bean *Apios priceana*	Threatened

Population:

No critical habitat has been designated for this species.

Species profile: https://ecos.fws.gov/ecp/species/7422

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Sep 1 to Jul 31
Kentucky Warbler *Oporornis formosus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31

NAME	BREEDING SEASON
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

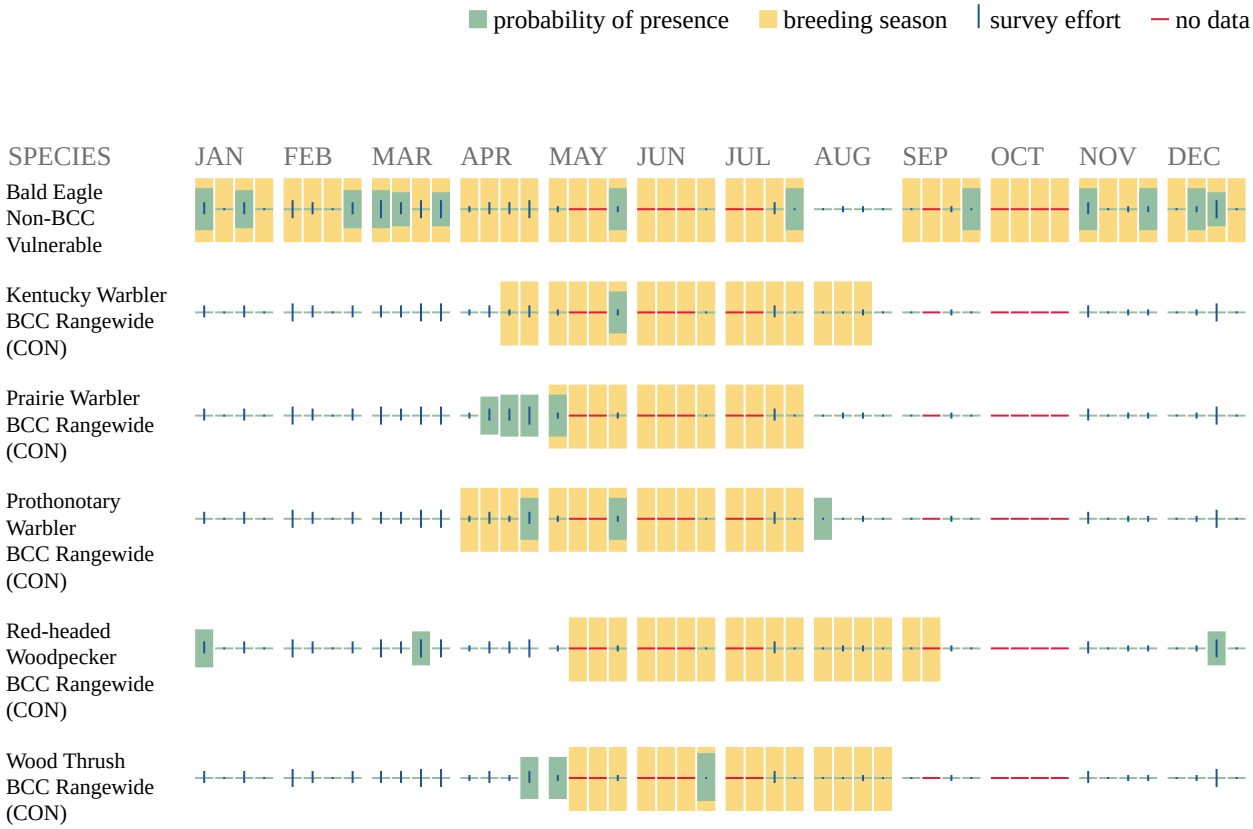
Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds

- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.
Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?
The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab

of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be

aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

WETLAND INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE VISIT HTTPS://WWW.FWS.GOV/WETLANDS/DATA/MAPPER.HTML OR CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

IPaC User Contact Information

Agency: Tennessee Valley Authority
Name: Elizabeth Hamrick
Address: 400 W Summit Hill Dr
City: Knoxville
State: TN
Zip: 37902
Email ecburton@tva.gov
Phone: 5034492373

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Tennessee Ecological Services Field Office
446 Neal Street
Cookeville, TN 38501-4027
Phone: (931) 528-6481 Fax: (931) 528-7075

In Reply Refer To: October 20, 2022
Project Code: 2023-0006928
Project Name: Gleason CT Site

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Tennessee Ecological Services Field Office
446 Neal Street
Cookeville, TN 38501-4027
(931) 528-6481

Project Summary

Project Code: 2023-0006928
Project Name: Gleason CT Site
Project Type: Mixed-Use Construction
Project Description: Transmission Line
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@36.246987700000005,-88.60895480925842,14z

Counties: Weakley County, Tennessee

Endangered Species Act Species

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

Reptiles

NAME	STATUS
Alligator Snapping Turtle *Macrochelys temminckii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4658	Proposed Threatened

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

REFUGE INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

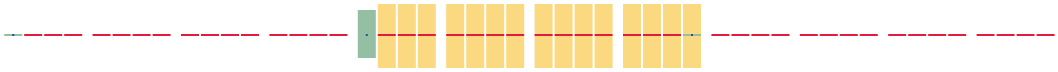
No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

■ probability of presence ■ breeding season | survey effort – no data

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

Wood Thrush
BCC Rangewide
(CON)



Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

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Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

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Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

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1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
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Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

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Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

WETLAND INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE VISIT HTTPS://WWW.FWS.GOV/WETLANDS/DATA/MAPPER.HTML OR CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

IPaC User Contact Information

Agency:	Marine Corps
Name:	Jenessa Kay
Address:	440 South Church Street
Address Line 2:	Suite 1200
City:	Charlotte
State:	NC
Zip:	28202
Email	jenessakay@gmail.com
Phone:	7043386839

Lead Agency Contact Information

Lead Agency: Tennessee Valley Authority

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Tennessee Ecological Services Field Office
446 Neal Street
Cookeville, TN 38501-4027
Phone: (931) 528-6481 Fax: (931) 528-7075

In Reply Refer To: October 20, 2022
Project Code: 2023-0006982
Project Name: JOF CT Site_Alt B

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Tennessee Ecological Services Field Office
446 Neal Street
Cookeville, TN 38501-4027
(931) 528-6481

Project Summary

Project Code: 2023-0006982
Project Name: JOF CT Site_Alt B
Project Type: Mixed-Use Construction
Project Description: Johnsonville CT Site
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@36.031247300000004,-87.98638851698828,14z

Counties: Humphreys County, Tennessee

Endangered Species Act Species

There is a total of 10 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Gray Bat *Myotis grisescens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6329	Endangered
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

Reptiles

NAME	STATUS
Alligator Snapping Turtle *Macrochelys temminckii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4658	Proposed Threatened

Clams

NAME	STATUS
Orangefoot Pimpleback (pearlymussel) *Plethobasus cooperianus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1132	Endangered
Pink Mucket (pearlymussel) *Lampsilis abrupta* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7829	Endangered
Ring Pink (mussel) *Obovaria retusa* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4128	Endangered
Rough Pigtoe *Pleurobema plenum* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6894	Endangered

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

REFUGE INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Sep 1 to Jul 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10

NAME	BREEDING SEASON
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
Brown-headed Nuthatch *Sitta pusilla* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 1 to Jul 15
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Eastern Whip-poor-will *Antrostomus vociferus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Field Sparrow *Spizella pusilla* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 1 to Aug 15
Golden Eagle *Aquila chrysaetos* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds elsewhere
Kentucky Warbler *Oporornis formosus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird *Euphagus carolinus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere

NAME	BREEDING SEASON
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

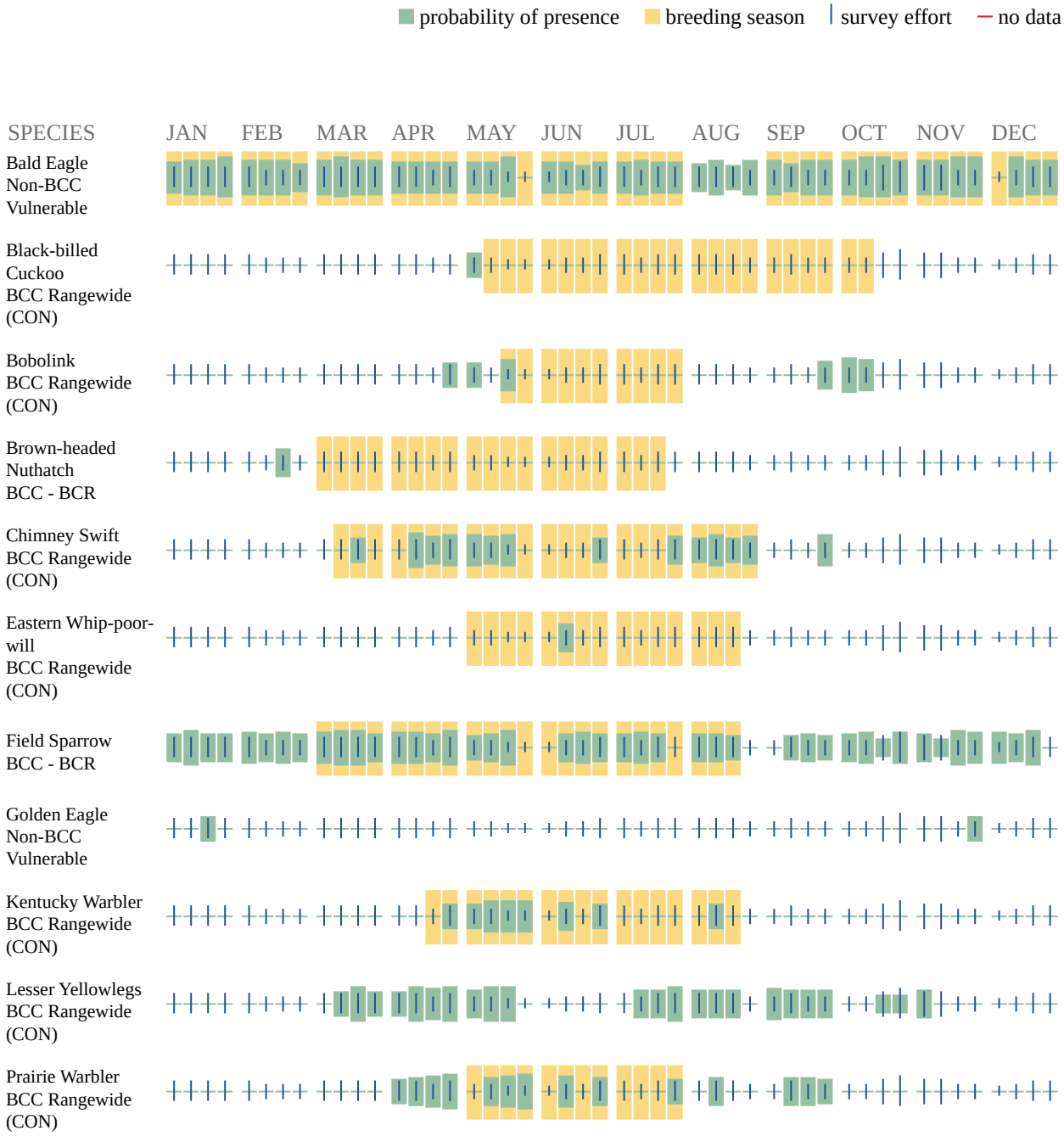
1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

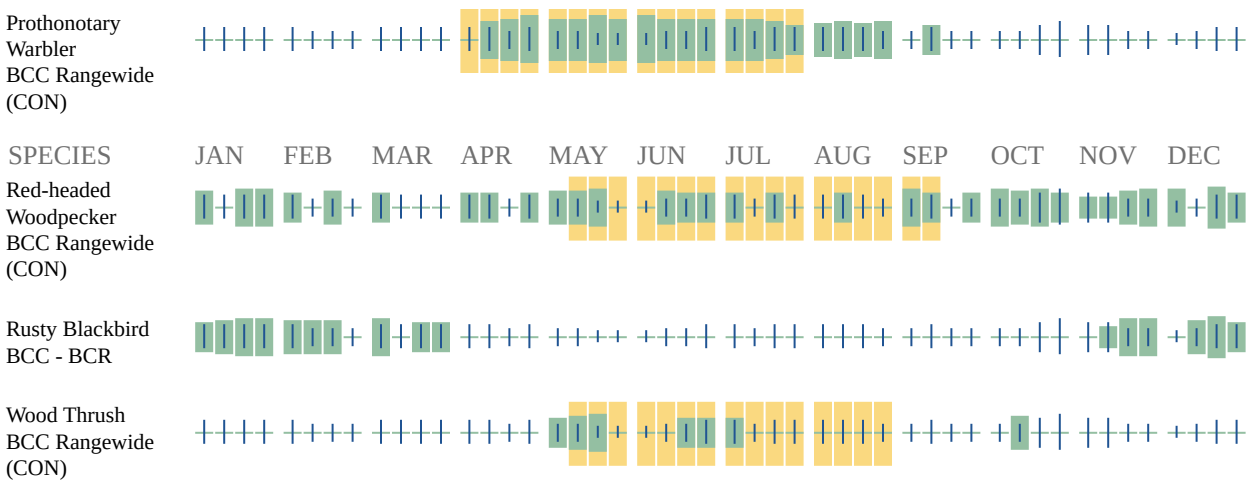
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

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Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

WETLAND INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE VISIT HTTPS://WWW.FWS.GOV/WETLANDS/DATA/MAPPER.HTML OR CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

IPaC User Contact Information

Agency:	Tennessee Valley Authority
Name:	Jenessa Kay
Address:	440 South Church Street
Address Line 2:	Suite 1200
City:	Charlotte
State:	NC
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Lead Agency Contact Information

Lead Agency: Tennessee Valley Authority

TN Department of Environment & Conservation

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Key to Status and Ranks

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Rare Species by County

Data is refreshed on or around January and July each year.

Go Rows 50 Actions

Row text contains 'stewart'

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County	Type	Category	Scientific Name	Common Name	Global Rank	State Rank	Fed. Status	State Status	Habitat	Wet Habitat Flag
Stewart	Vascular Plant	Flowering Plant	Sagittaria brevirostra	Short-beaked Arrowhead	G5	S1	--	T	Swamps And Floodplains	Possible
Stewart	Vertebrate Animal	Reptile	Macrochelys temminckii	Alligator Snapping Turtle	G3	S2S3	--	T	Slow moving, deep water of rivers, sloughs, oxbows, swamps, and lakes; middle and west Tennessee; obscure.	Aquatic
Stewart	Vertebrate Animal	Bird	Thryomanes bewickii	Bewick's Wren	G5	S1	--	D	Brushy areas, thickets and scrub in open country, open and riparian woodland.	Upland
Stewart	Vascular Plant	Flowering Plant	Eleocharis lanceolata	Lance-like Spike-rush	G4G5	S1	--	S	Wet Areas	Possible
Stewart	Vascular Plant	Flowering Plant	Apios priceana	Price's Potato-bean	G3	S3	LT	E	Openings In Rich Woods	Possible
Stewart	Vertebrate Animal	Bird	Aquila chrysaetos	Golden Eagle	G5	S1	--	D	Open country, open wooded country, and barren areas, especially in hilly or mountainous regions.	Upland
Stewart	Vertebrate Animal	Fish	Cycleptus elongatus	Blue Sucker	G3G4	S2	--	T	Swift waters over firm substrates in big rivers.	Aquatic
Stewart	Vertebrate Animal	Bird	Setophaga cerulea	Cerulean Warbler	G4	S3B	--	D	Mature deciduous forest, particularly in floodplains or mesic conditions.	Upland
Stewart	Vertebrate Animal	Mammal	Myotis sodalis	Indiana Myotis	G2	S1	LE	E	Hibernates in caves; spring/summer maternity roosts are normally under the bark of standing trees.	Upland
Stewart	Vascular Plant	Flowering Plant	Prenanthes barbata	Bearded Rattlesnake-root	G3	S2	--	S	Barrens And Dry Woodlands	Upland
Stewart	Vascular Plant	Flowering Plant	Baptisia bracteata var. leucophaea	Cream Wild-indigo	G4G5T4T5	S1S2	--	S	Dry Oak Woods And Barrens	Upland
Stewart	Invertebrate Animal	Mollusc	Lampsilis abrupta	Pink Mucket	G1G2	S2	LE	E	Generally a large river species, preferring sand-gravel or rocky substrates with mod-strong currents; Tennessee & Cumberland river systems.	Aquatic
Stewart	Vertebrate Animal	Mammal	Myotis grisescens	Gray Myotis	G4	S2	LE	E	Cave obligate year-round; frequents forested areas; migratory.	Upland
Stewart	Vascular Plant	Flowering	Heteranthera limosa	Blue Mud-	G5	S1S2	--	T	Mud Flats	Possible

		Plant		plantain						
Stewart	Vertebrate Animal	Fish	Acipenser fulvescens	Lake Sturgeon	G3G4	S1	--	E	Bottoms of large, clean rivers and lakes.	Aquatic
Stewart	Vascular Plant	Flowering Plant	Heracleum maximum	Cow-parsnip	G5	S2	--	S	Moist Woods And Floodplains	Possible
Stewart	Vascular Plant	Flowering Plant	Juglans cinerea	Butternut	G3	S3	--	T	Rich Woods And Hollows	Possible
Stewart	Vertebrate Animal	Reptile	Pituophis melanoleucus melanoleucus	Northern Pinesnake	G4T4	S3	--	T	Well-drained sandy soils in pine/pine-oak woods; dry mountain ridges; E portions of west TN, E to lower elev of the Appalachians.	Upland
Stewart	Vascular Plant	Flowering Plant	Carex comosa	Bristly Sedge	G5	S2	--	T	Swamps	Possible
Stewart	Vascular Plant	Flowering Plant	Iris brevicaulis	Lamance Iris	G4	S1	--	E	Bottomlands	Possible
Stewart	Vascular Plant	Flowering Plant	Panax quinquefolius	American Ginseng	G3G4	S3S4	--	S-CE	Rich Woods	Possible
Stewart	Vascular Plant	Flowering Plant	Aureolaria patula	Spreading False-foxglove	G3	S3	--	S	Oak Woods And Edges	Upland
Stewart	Vertebrate Animal	Bird	Ammodramus henslowii	Henslow's Sparrow	G4	S1B	--	T	Damp open fields and meadows with grass interspersed with weeds or shrubs.	Upland
Stewart	Vascular Plant	Flowering Plant	Salvia azurea var. grandiflora	Blue Sage	G4G5T4?	S3	--	S	Barrens	Upland
Stewart	Vertebrate Animal	Reptile	Sistrurus miliarius streckeri	Western Pygmy Rattlesnake	G5T5	S2S3	--	T	Usually near water in river floodplains, swamps, marshes, and wet prairies; occas drier wooded uplands; W half of Tenn., generally.	Possible
Stewart	Vascular Plant	Flowering Plant	Eleocharis intermedia	Matted Spike-rush	G5	S1	--	E	Wet Areas	Possible
Stewart	Vascular Plant	Flowering Plant	Liparis loeselii	Fen Orchis	G5	S1	--	T	Calcareous Seeps	Possible
Stewart	Vascular Plant	Flowering Plant	Pedicularis lanceolata	Swamp Lousewort	G5	S1S2	--	S	Wet Acidic Barrens And Seeps	Possible
Stewart	Vascular Plant	Flowering Plant	Rudbeckia subtomentosa	Sweet Coneflower	G5	S2	--	T	Barrens	Possible
Stewart	Vascular Plant	Flowering Plant	Hieracium longipilum	Hairy Hawkweed	G4G5	S1	--	S	Dry Fields And Sandy Road Banks	Upland
Stewart	International Terrestrial Ecological System Classification	Plant Community	Central Interior Highlands and Appalachian Sinkhole and Depression Pond	Highland Rim Sinkhole and Depression Pond	GNR	S2S3	--	Rare, Not State Listed	No Data	No Data
Stewart	Vascular Plant	Flowering Plant	Asclepias purpurascens	Purple Milkweed	G5?	S1	--	S	Barrens	Possible
Stewart	Vertebrate Animal	Amphibian	Cryptobranchus alleganiensis	Hellbender	G3	S3	No Status	E	Rocky, clear creeks and rivers with large shelter rocks.	Aquatic
Stewart	Vascular Plant	Flowering Plant	Hasteola suaveolens	Sweet-scented Indian-plantain	G4	S2	--	S	Alluvial Woods, Moist Slopes	Possible
Stewart	Vascular Plant	Flowering Plant	Neobeckia aquatica	Lake Cress	G4?	S2	--	S	Gum Or Cypress Swamps	Possible
Stewart	Vascular Plant	Flowering Plant	Phlox pilosa ssp. ozarkana	Ozark Downy Phlox	G5T4?	S1S2	--	S	Rocky, Dry Open Woods	Upland
Stewart	Vascular Plant	Flowering Plant	Lysimachia fraseri	Fraser's Loosestrife	G3	S2	--	E	Dry Open Woods	Possible
Stewart	Vertebrate Animal	Bird	Limnothlypis swainsonii	Swainson's Warbler	G4	S3	--	D	Mature, rich, damp, deciduous floodplain and swamp forests.	Possible

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Rare Species by County

Data is refreshed on or around January and July each year.

Go Rows All Actions

Row text contains 'Humphreys'

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County	Type	Category	Scientific Name	Common Name	Global Rank	State Rank	Fed. Status	State Status	Habitat	Wet Habitat Flag
Humphreys	Vascular Plant	Flowering Plant	Sagittaria brevirostra	Short-beaked Arrowhead	G5	S1	--	T	Swamps And Floodplains	Possible
Humphreys	Vertebrate Animal	Reptile	Macrochelys temminckii	Alligator Snapping Turtle	G3	S2S3	--	T	Slow moving, deep water of rivers, sloughs, oxbows, swamps, and lakes; middle and west Tennessee; obscure.	Aquatic
Humphreys	Animal Assemblage	No Data	Rookery	Heron Rookery	G5	SNR	--	Rare, Not State Listed	No Data	No Data
Humphreys	Vertebrate Animal	Fish	Etheostoma aquali	Coppercheek Darter	G2G3	S2S3	--	T	Primarily in deep riffles, runs, and flowing pools; Duck and Buffalo River watersheds.	Aquatic
Humphreys	Vertebrate Animal	Bird	Thryomanes bewickii	Bewick's Wren	G5	S1	--	D	Brushy areas, thickets and scrub in open country, open and riparian woodland.	Upland
Humphreys	Vertebrate Animal	Fish	Noturus stanauli	Pygmy Madtom	G1	S1	LE, XN	E	Medium to large rivers with moderate to strong current over gravel substrates; Tennessee River watershed.	Aquatic
Humphreys	Vascular Plant	Flowering Plant	Spiranthes odorata	Sweetscent Ladies'-tresses	G5	S1	--	E	Swamps, Pond Margins	Possible
Humphreys	Invertebrate Animal	Mollusc	Pleurobema clava	Clubshell	G1G2	SH	LE	E	Small/med-sized rivers and streams; deeply buried in sand/fine gravel or in clean, coarse sand/gravel runs; lower Cumb. & Tenn. rivers.	Aquatic
Humphreys	Vertebrate Animal	Fish	Cycleptus elongatus	Blue Sucker	G3G4	S2	--	T	Swift waters over firm substrates in big rivers.	Aquatic
Humphreys	Vascular Plant	Flowering Plant	Bolboschoenus fluviatilis	River Bulrush	G5	S1	--	S	Marshes	Possible
Humphreys	Vascular Plant	Flowering Plant	Echinochloa walteri	Walter's Barnyard Grass	G5	S1	--	S	Bottomlands And Marshes	Possible
Humphreys	Vascular Plant	Flowering Plant	Prenanthes barbata	Bearded Rattlesnake-root	G3	S2	--	S	Barrens And Dry Woodlands	Upland
Humphreys	Vascular Plant	Flowering Plant	Boechera shortii	Short's Rock-cress	G5	S1S2	--	S	Wooded Bluffs & Floodplains	Possible
Humphreys	Invertebrate Animal	Mollusc	Lampsilis abrupta	Pink Mucket	G1G2	S2	LE	E	Generally a large river species, preferring sand-gravel or rocky substrates with mod-strong currents; Tennessee & Cumberland river systems.	Aquatic
Humphreys	Vertebrate Animal	Fish	Percina phoxocephala	Slenderhead Darter	G5	S3	--	D	Small-large rivers with moderate gradient in shoal areas with moderate-swift currents; portions of Tenn & Cumb river watersheds.	Aquatic

Humphreys	Vertebrate Animal	Fish	Noturus fasciatus	Saddled Madtom	G2	S2	--	T	Rocky riffles, runs, and flowing pools of clear creeks & small rivers; Duck River system and nearby tributaries of the Tennessee River.	Aquatic
Humphreys	Invertebrate Animal	Mollusc	Cumberlandia monodonta	Spectaclecase	G3	S2S3	LE	E	Medium to large rivers; in substrates from mud and sand to gravel, cobble, and boulders; Cumberland and Tennessee river systems.	Aquatic
Humphreys	Vascular Plant	Flowering Plant	Heteranthera limosa	Blue Mud-plantain	G5	S1S2	--	T	Mud Flats	Possible
Humphreys	Vertebrate Animal	Fish	Percina apina	Tennessee Logperch	GNR	S2	--	D	Duck River system and Whiteoak Creek; currently restricted to the Western Highland Rim.	No Data
Humphreys	Vascular Plant	Flowering Plant	Pseudognaphalium helleri	Heller's Catfoot	G4G5	S2	--	S	Dry Sandy Woods	Upland
Humphreys	Invertebrate Animal	Mollusc	Simpsonaias ambigua	Salamander Mussel	G3	S1	--	Rare, Not State Listed	In sand or silt under large, flat stones in areas of swift current; occurred historically in E Fk Stones R; 2005 obs in lower Duck R.	Aquatic
Humphreys	Invertebrate Animal	Mollusc	Pleuronaia dolabelloides	Slabside Pearlymussel	G2	S2	LE	E	Lg creeks to mod sized rivers, in riffles/shoals of sand, fine gravel, and cobble substrates with mod current; Tennessee R watershed.	Aquatic
Humphreys	Vertebrate Animal	Reptile	Pituophis melanoleucus melanoleucus	Northern Pinesnake	G4T4	S3	--	T	Well-drained sandy soils in pine/pine-oak woods; dry mountain ridges; E portions of west TN, E to lower elev of the Appalachians.	Upland
Humphreys	Invertebrate Animal	Mollusc	Pleurobema plenum	Rough Pigtoe	G1	S1	LE, XN	E	Medium to large rivers in sand, gravel, and cobble substrates of shoals; Tennessee & Cumberland river systems.	Aquatic
Humphreys	Invertebrate Animal	Mollusc	Obovaria retusa	Ring Pink	G1	S1	LE,XN	E	Large rivers in gravel and sand bars; Tennessee & Cumberland river watersheds; many historic locations currently inundated.	Aquatic
Humphreys	Invertebrate Animal	Mollusc	Lithasia duttoniana	Helmet Rocksnail	G2Q	S2	--	Rare, Not State Listed	Rocky substrates in riffle systems; bedrock in flowing water below main section of riffles; Duck River (TN River system).	Aquatic
Humphreys	Vertebrate Animal	Fish	Carpiodes velifer	Highfin Carpsucker	G4G5	S2S3	--	D	Large rivers, mostly in Tennessee River drainage.	Aquatic
Humphreys	Invertebrate Animal	Mollusc	Plethobasus cooperianus	Orangefoot Pimpleback	G1	S1	LE, XN	E	Large rivers in sand-gravel-cobble substrates in riffles and shoals in deep flowing water; Cumberland & Tennessee river systems.	Aquatic
Humphreys	Vascular Plant	Flowering Plant	Iris brevicaulis	Lamance Iris	G4	S1	--	E	Bottomlands	Possible
Humphreys	Vascular Plant	Flowering Plant	Panax quinquefolius	American Ginseng	G3G4	S3S4	--	S-CE	Rich Woods	Possible
Humphreys	Invertebrate Animal	Mollusc	Theliderma cylindrica cylindrica	Rabbitsfoot	G3G4T3	S3	LT	T	Large rivers in sand and gravel; Tennessee & Cumberland systems; big river form of Q. cylindrica.	Aquatic
Humphreys	Vertebrate Animal	Mammal	Neotoma magister	Allegheny Woodrat	G3G4	S3	--	D	Outcrops, cliffs, talus slopes, crevices,	Upland

									sinkholes, caves & karst.	
Humphreys	Vertebrate Animal	Fish	Etheostoma denoncourti	Golden Darter	G2	S2	--	D	Medium to large rivers in shallow riffle areas of pea gravel; Tennessee River system.	Aquatic
Humphreys	Vertebrate Animal	Reptile	Sistrurus miliarius streckeri	Western Pygmy Rattlesnake	G5T5	S2S3	--	T	Usually near water in river floodplains, swamps, marshes, and wet prairies; occas drier wooded uplands; W half of Tenn., generally.	Possible
Humphreys	Vascular Plant	Flowering Plant	Liparis loeselii	Fen Orchis	G5	S1	--	T	Calcareous Seeps	Possible
Humphreys	Vascular Plant	Flowering Plant	Carex reniformis	Reniform Sedge	G4?	S1	--	S	Rich Bottomland Woods	Possible
Humphreys	Vertebrate Animal	Amphibian	Cryptobranchus alleganiensis	Hellbender	G3	S3	No Status	E	Rocky, clear creeks and rivers with large shelter rocks.	Aquatic
Humphreys	Vascular Plant	Flowering Plant	Hasteola suaveolens	Sweet-scented Indian-plantain	G4	S2	--	S	Alluvial Woods, Moist Slopes	Possible
Humphreys	Vascular Plant	Flowering Plant	Carex hirtifolia	Pubescent Sedge	G5	S1S2	--	S	Lowland Forests	Possible

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If you have any questions or comments, Email ask.tdec@tn.gov or call at (888) 891-TDEC (8332).

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Rare Species by County

Data is refreshed on or around January and July each year.

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Row text contains 'weakley'

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County	Type	Category	Scientific Name	Common Name	Global Rank	State Rank	Fed. Status	State Status	Habitat	Wet Habitat Flag
Weakley	Animal Assemblage	No Data	Rookery	Heron Rookery	G5	SNR	--	Rare, Not State Listed	No Data	No Data
Weakley	Vertebrate Animal	Fish	Noturus gladiator	Piebald Madtom	G3	S3	--	D	Large creeks & rivers in moderate-swift currents with clean sand or gravel substrates; Mississippi River tributaries.	Aquatic
Weakley	Vascular Plant	Fern and Fern Ally	Dryopteris carthusiana	Spinulose Shield Fern	G5	S1	--	T	Bogs	Possible
Weakley	Vascular Plant	Flowering Plant	Helianthus occidentalis	Naked-stem Sunflower	G5	S2	--	S	Limestone Glades And Barrens	Upland
Weakley	Vascular Plant	Flowering Plant	Chelone obliqua	Red Turtlehead	G4	S1	--	S	Alluvial Swamps, Wet Woods	Possible
Weakley	Invertebrate Animal	Crustacean	Creaserinus hortoni	Hatchie Burrowing Crayfish	G1	S1	--	E	Primary burrower; uses saturated or seasonally saturated soils associated with permanent bodies of water; Mississippi River tributaries, Coastal Plain.	Aquatic
Weakley	Vertebrate Animal	Mammal	Myotis austroriparius	Southeastern Myotis	G4	S3	--	Rare, Not State Listed	Caves, but especially hollow trees & abandoned buildings, usually near water.	Possible
Weakley	Vascular Plant	Flowering Plant	Polygonum arifolium	Halberd-leaf Tearthumb	G5	S1	--	T	Wetlands And Marshes	Possible
Weakley	Vertebrate Animal	Fish	Etheostoma pyrrhogaster	Firebelly Darter	G2G3	S2	--	D	Sand- and gravel-bottomed pools of headwaters, creeks, and small rivers; upper Coastal Plain in Obion River watershed; west Tennessee.	Aquatic
Weakley	Vertebrate Animal	Mammal	Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	G3G4	S3	--	D	Caves, hollow trees, abandoned buildings; often associated with forested areas.	Upland
Weakley	Vascular Plant	Flowering Plant	Didiplis diandra	Water-purslane	G5	S1	--	T	Swamps	Possible
Weakley	Vertebrate Animal	Mammal	Synaptomys cooperi	Southern Bog Lemming	G5	S4	--	D	Marshy meadows, wet balds, & rich upland forests.	Possible
Weakley	Vascular Plant	Flowering Plant	Crataegus harbisonii	Harbison's Hawthorn	G1	S1	--	E	Dry Rocky Calcareous Woods	Upland
Weakley	Vertebrate Animal	Bird	Limnothlypis swainsonii	Swainson's Warbler	G4	S3	--	D	Mature, rich, damp, deciduous floodplain and swamp forests.	Possible

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Appendix L – CUF USFWS Bat Consultations

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The Programmatic Biological Assessment and USFWS Biological Opinion can be accessed from the following website (Reports available upon request)

- Tennessee Valley Authority (TVA). 2017. Programmatic Biological Assessment for Evaluation of the Impacts of Tennessee Valley Authority's Routine Actions on Federally Listed Bats. Tennessee Valley Authority, Knoxville, Tennessee. September 2017 (Revision 2, Final). Available online [URL]: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/environmental-stewardship/nepa-environmental-reviews/programmatic-biological-assessment-for-evaluation-of-the-impacts-of-tva-s-routine-actions-on-federally-listed-bats.pdf?sfvrsn=ebc6f226_2
- U.S. Fish and Wildlife Service (USFWS). 2018. Biological Opinion, Programmatic Strategy for Routine Actions that May Affect Endangered or Threatened Bats. FWS Log#: 04ET1000-2018-F-0017. Tennessee Ecological Services Office, Cookeville, Tennessee. Available online [URL]: https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/environmental-stewardship/environmental-reviews/bats/bat_biological_opinion_usfws.pdf?sfvrsn=e822b48f_0

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Tennessee ES Office
446 Neal Street
Cookeville, Tennessee 38501

March 8, 2018

Ms. Holly LeGrand
Program Manager, Endangered Species Policy
Tennessee Valley Authority
400 West Summit Hill Drive, WTK11-C
Knoxville, TN 37902-1499

Re: FWS Log # 04ET1000-2018-F-0017; TVA Project # 2017-21; Bat Programmatic Strategy

Dear Ms. LeGrand:

This letter is in response to your request for a letter of concurrence regarding determinations in the Biological Assessment (BA) of TVA's proposed Bat Programmatic Strategy (the Action) for activities that are not likely to adversely affect federally-listed species of bats. As you discussed with U.S. Fish and Wildlife Service (Service) Southeast Regional Office staff on March 6, 2018, our Biological Opinion (BO) for the Bat Programmatic Strategy is still under preparation; however, our analysis of the activities that are not likely to adversely affect listed species or critical habitats is complete.

TVA determined that all 96 activities of the proposed Action are not likely to adversely affect the gray bat *(Myotis grisescens)*, Virginia big-eared bat *(Corynorhinus townsendii virginianus)*, and designated critical habitats for the Indiana bat *(Myotis sodalis)*. The Service has reviewed the data and rationale for these determinations provided in the BA and concurs. We agree that the proposed conservation measures associated with the activities that may affect these species and critical habitats wit I limit any adverse effects to an insignificant scale or discountable probability.

TVA also determined that 72 of the 96 activities of the proposed Action, specifically Activities 15—18, 21—22, 24—32, 35--40, and 45--48, 50-96, are not likely to adversely affect the Indiana bat *or* northern long-eared bat *(Myotis septentrionalis)*. The Service has reviewed the data and rationale for these determinations provided in the BA and concurs. We agree that the proposed conservation measures associated with the activities that may affect these species will limit any adverse effects to an insignificant scale or discountable probability.

This concurrence letter concludes consultation for the Action relative to: (a) the gray bat; (b) Virginia big-eared bat; (c) designated critical habitats for the Indiana bat and Virginia big-eared

bat; and (d) those activities listed above that we have concurred are not likely to adversely affect the Indiana bat or northern long-eared bat. Therefore, the Service will not address these species, critical habitats, and activities in the pending Biological Opinion (BO). Reinitiating the consultation relative to (a)—(d) above is required if TVA retains discretionary involvement or control over the Action (or is authorized by law) when:

- new information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in the BA;
- the Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in the BA; or
- a new species is listed or critical habitat designated that the Action may affect.

The Service shall proceed with completing the BO regarding those activities that TVA has determined are likely to adversely affect the Indiana bat or northern long-eared bat.

If you have any questions or concerns about this concurrence letter, the pending BO, or the consultation process in general, please feel free to contact myself or Todd Shaw of this office at 931/525-4985, or at *ross eov*.

Sincerely,

Mary E. Jennings
Field Supervisor

Project Review Form - TVA Bat Strategy *(06/2019)*

*This form should **only** be completed if project includes activities in Tables 2 or 3 (STEP 2 below). This form is not required if project activities are limited to Table 1 (STEP 2) or otherwise determined to have no effect on federally listed bats. If so, include the following statement in your environmental compliance document (e.g., add as a comment in the project CEC): "Project activities limited to Bat Strategy Table 1 or otherwise determined to have no effect on federally listed bats. Bat Strategy Project Review Form NOT required." This form is to assist in determining required conservation measures per TVA's ESA Section 7 programmatic consultation for routine actions and federally listed bats.*[1]

Project Name: Cumberland Retirement Environmental Impact Statement (EIS) **Date:** Aug 19, 2022

Contact(s): Ashley Pilakowski/Emily Willard **CEC#:** 202113 **Project ID:** ESCS38806

Project Location (City, County, State): Cumberland City, Stewart County, Tennessee

Project Description:

Retirement and Decommissioning, Deconstruction and Demolition of CUF, and proposed replacement generation of a CC gas plant at the CUF location.

SECTION 1: PROJECT INFORMATION - ACTION AND ACTIVITIES

STEP 1) Select TVA Action. If none are applicable, contact environmental support staff, Environmental Project Lead, or Terrestrial Zoologist to discuss whether form (i.e., application of Bat Programmatic Consultation) is appropriate for project:

- ☐ 1 Manage Biological Resources for Biodiversity and Public Use on TVA Reservoir Lands
- ☐ 2 Protect Cultural Resources on TVA-Retained Land
- ☐ 3 Manage Land Use and Disposal of TVA-Retained Land
- ☐ 4 Manage Permitting under Section 26a of the TVA Act
- ☒ 5 Operate, Maintain, Retire, Expand, Construct Power Plants
- ☐ 6 Maintain Existing Electric Transmission Assets
- ☐ 7 Convey Property associated with Electric Transmission
- ☐ 8 Expand or Construct New Electric Transmission Assets
- ☐ 9 Promote Economic Development
- ☐ 10 Promote Mid-Scale Solar Generation

STEP 2) Select all activities from Tables 1, 2, and 3 below that are included in the proposed project.

TABLE 1. Activities with no effect to bats. Conservation measures & completion of bat strategy project review form NOT required.

☐ 1. Loans and/or grant awards	☐ 8. Sale of TVA property	☐ 19. Site-specific enhancements in streams and reservoirs for aquatic animals
☐ 2. Purchase of property	☐ 9. Lease of TVA property	☐ 20. Nesting platforms
☐ 3. Purchase of equipment for industrial facilities	☐ 10. Deed modification associated with TVA rights or TVA property	☐ 41. Minor water-based structures (this does not include boat docks, boat slips or piers)
☐ 4. Environmental education	☐ 11. Abandonment of TVA retained rights	☐ 42. Internal renovation or internal expansion of an existing facility
☐ 5. Transfer of ROW easement and/or ROW equipment	☐ 12. Sufferance agreement	☒ 43. Replacement or removal of TL poles
☐ 6. Property and/or equipment transfer	☐ 13. Engineering or environmental planning or studies	☐ 44. Conductor and overhead ground wire installation and replacement
☐ 7. Easement on TVA property	☐ 14. Harbor limits delineation	☐ 49. Non-navigable houseboats

TABLE 2. Activities not likely to adversely affect bats with implementation of conservation measures. Conservation measures and completion of bat strategy project review form REQUIRED; review of bat records in proximity to project NOT required.

■ 18. Erosion control, minor	☐ 57. Water intake - non-industrial	☐ 79. Swimming pools/associated equipment
☐ 24. Tree planting	☐ 58. Wastewater outfalls	☐ 81. Water intakes – industrial
☐ 30. Dredging and excavation; recessed harbor areas	☐ 59. Marine fueling facilities	■ 84. On-site/off-site public utility relocation or construction or extension
☐ 39. Berm development	☐ 60. Commercial water-use facilities (e.g., marinas)	☐ 85. Playground equipment - land-based
☐ 40. Closed loop heat exchangers (heat pumps)	☐ 61. Septic fields	☐ 87. Aboveground storage tanks
☐ 45. Stream monitoring equipment - placement and use	☐ 66. Private, residential docks, piers, boathouses	☐ 88. Underground storage tanks
☐ 46. Floating boat slips within approved harbor limits	■ 67. Siting of temporary office trailers	☐ 90. Pond closure
■ 48. Laydown areas	☐ 68. Financing for speculative building construction	☐ 93. Standard License
☐ 50. Minor land based structures	☐ 72. Ferry landings/service operations	☐ 94. Special Use License
☐ 51. Signage installation	☐ 74. Recreational vehicle campsites	☐ 95. Recreation License
☐ 53. Mooring buoys or posts	■ 75. Utility lines/light poles	☐ 96. Land Use Permit
☐ 56. Culverts	☐ 76. Concrete sidewalks	

Table 3: Activities that may adversely affect federally listed bats. Conservation measures AND completion of bat strategy project review form REQUIRED; review of bat records in proximity of project REQUIRED by OSAR/Heritage eMap reviewer or Terrestrial Zoologist.

☐ 15. Windshield and ground surveys for archaeological resources	■ 34. Mechanical vegetation removal, includes trees or tree branches > 3 inches in diameter	☐ 69. Renovation of existing structures
■ 16. Drilling	☐ 35. Stabilization (major erosion control)	☐ 70. Lock maintenance/ construction
■ 17. Mechanical vegetation removal, does not include trees or branches > 3" in diameter (in Table 3 due to potential for woody burn piles)	■ 36. Grading	☐ 71. Concrete dam modification
■ 21. Herbicide use	☐ 37. Installation of soil improvements	☐ 73. Boat launching ramps
☐ 22. Grubbing	☐ 38. Drain installations for ponds	■ 77. Construction or expansion of land-based buildings
☐ 23. Prescribed burns	☐ 47. Conduit installation	☐ 78. Wastewater treatment plants
☐ 25. Maintenance, improvement or construction of pedestrian or vehicular access corridors	☐ 52. Floating buildings	☐ 80. Barge fleeting areas
☐ 26. Maintenance/construction of access control measures	☐ 54. Maintenance of water control structures (dewatering units, spillways, levees)	☐ 82. Construction of dam/weirs/ levees
■ 27. Restoration of sites following human use and abuse	☐ 55. Solar panels	☐ 83. Submarine pipeline, directional boring operations
■ 28. Removal of debris (e.g., dump sites, hazardous material, unauthorized structures)	■ 62. Blasting	☐ 86. Landfill construction
☐ 29. Acquisition and use of fill/borrow material	■ 63. Foundation installation for transmission support	■ 89. Structure demolition
■ 31. Stream/wetland crossings	■ 64. Installation of steel structure, overhead bus, equipment, etc.	☐ 91. Bridge replacement
☐ 32. Clean-up following storm damage	■ 65. Pole and/or tower installation and/or extension	☐ 92. Return of archaeological remains to former burial sites
☐ 33. Removal of hazardous trees/tree branches		

STEP 3) Project includes one or more activities in Table 3? ◉ **YES (Go to Step 4)** ○ **NO (Go to Step 13)**

STEP 4) Answer questions *a* through *e* below (applies to projects with activities from Table 3 ONLY)

a) Will project involve continuous noise (i.e., ≥ 24 hrs) that is greater than 75 decibels measured on the A scale (e.g., loud machinery)?

- ◉ **NO** (NV2 does not apply)
- ○ **YES** (NV2 applies, subject to records review)

b) Will project involve entry into/survey of cave?

- ◉ **NO** (HP1/HP2 do not apply)
- ○ **YES** (HP1/HP2 applies, subject to review of bat records)

c) If conducting **prescribed burning** (**activity 23**), estimated acreage**:** [ ] and timeframe(s) below; ■ **N/A**

STATE	SWARMING	WINTER	NON-WINTER	PUP
GA, KY, TN	☐ Oct 15 - Nov 14	☐ Nov 15 - Mar 31	☐ Apr 1 - May 31, Aug 1- Oct 14	☐ Jun 1 - Jul 31
VA	☐ Sep 16 - Nov 15	☐ Nov 16 - Apr 14	☐ Apr 15 - May 31, Aug 1 – Sept 15	☐ Jun 1 - Jul 31
AL	☐ Oct 15 - Nov 14	☐ Nov 15 - Mar 15	☐ Mar 16 - May 31, Aug 1 - Oct 14	☐ Jun 1 - Jul 31
NC	☐ Oct 15 - Nov 14	☐ Nov 15 - Apr 15	☐ Apr 16 - May 31, Aug 1 - Oct 14	☐ Jun 1 - Jul 31
MS	☐ Oct 1 - Nov 14	☐ Nov 15 - Apr 14	☐ Apr 15 - May 31, Aug 1 – Sept 30	☐ Jun 1 - Jul 31

d) Will the project involve vegetation piling/burning?

- ○ **NO** (SSPC4/ SHF7/SHF8 do not apply)
- ◉ **YES** (SSPC4/SHF7/SHF8 applies, subject to review of bat records)

e) If **tree removal (activity 33 or 34)**, estimated amount: 42.89 ◉ **ac** ○ **trees** ○ **N/A**

STATE	SWARMING	WINTER	NON-WINTER	PUP
GA, KY, TN	☐ Oct 15 - Nov 14	■ Nov 15 - Mar 31	☐ Apr 1 - May 31, Aug 1- Oct 14	☐ Jun 1 - Jul 31
VA	☐ Sep 16 - Nov 15	☐ Nov 16 - Apr 14	☐ Apr 15 - May 31, Aug 1 – Sept 15	☐ Jun 1 - Jul 31
AL	☐ Oct 15 - Nov 14	☐ Nov 15 - Mar 15	☐ Mar 16 - May 31, Aug 1 - Oct 14	☐ Jun 1 - Jul 31
NC	☐ Oct 15 - Nov 14	☐ Nov 15 - Apr 15	☐ Apr 16 - May 31, Aug 1 - Oct 14	☐ Jun 1 - Jul 31
MS	☐ Oct 1 - Nov 14	☐ Nov 15 - Apr 14	☐ Apr 15 - May 31, Aug 1 – Sept 30	☐ Jun 1 - Jul 31

If warranted, does project have flexibility for bat surveys (May 15-Aug 15): ◉ **MAYBE** ○ **YES** ○ **NO**

**** For **PROJECT LEADS** whose projects will be reviewed by a Heritage Reviewer (Natural Resources Organization only), **STOP HERE**. Click File/ Save As, name form as "ProjectLead_BatForm_CEC-or-ProjectIDNo_Date", and submit with project information. Otherwise continue to Step 5. ****

SECTION 2: REVIEW OF BAT RECORDS (applies to projects with activities from Table 3 ONLY)

STEP 5) Review of bat/cave records conducted by Heritage/OSAR reviewer?

◉ **YES** ○ **NO** (Go to Step 13)

Info below completed by:

☐ **Heritage Reviewer**	(name)		Date	
☐ **OSAR Reviewer**	(name)		Date	
■ **Terrestrial Zoologist**	(name)	Elizabeth Hamrick	Date	Apr 14, 2022

Gray bat records: ☐ None ☐ Within 3 miles* ☐ Within a cave* ☒ Within the County

Indiana bat records: ☐ None ☒ Within 10 miles* ☒ Within a cave* ☒ Capture/roost tree* ☒ Within the County

Northern long-eared bat records: ☐ None ☒ Within 5 miles* ☒ Within a cave* ☒ Capture/roost tree* ☒ Within the County

Virginia big-eared bat records: ☒ None ☐ Within 6 miles* ☐ Within the County

Caves: ☒ None within 3 mi ☐ Within 3 miles but > 0.5 mi ☐ Within 0.5 mi but > 0.25 mi* ☐ Within 0.25 mi but > 200 feet* ☐ Within 200 feet*

Bat Habitat Inspection Sheet completed? ◉ **NO** ○ **YES**

Amount of SUITABLE habitat to be removed/burned (may differ from STEP 4e): 42.89 (◉ **ac** ○ **trees)*** ○ **N/A**

STEP 6) Provide any additional notes resulting from Heritage Reviewer records review in Notes box below then . . . . . Go to Step 13

Notes from Bat Records Review (e.g., historic record; bats not on landscape during action; DOT bridge survey with negative results):

STEPS 7-12 To be Completed by Terrestrial Zoologist (if warranted):

STEP 7) Project will involve:

- ☐ Removal of suitable trees within 0.5 mile of P1-P2 Indiana bat hibernacula or 0.25 mile of P3-P4 Indiana bat hibernacula or any NLEB hibernacula.
- ☒ Removal of suitable trees within 10 miles of documented Indiana bat (or within 5 miles of NLEB) hibernacula.
- ☐ Removal of suitable trees > 10 miles from documented Indiana bat (> 5 miles from NLEB) hibernacula.
- ☐ Removal of trees within 150 feet of a documented Indiana bat or northern long-eared bat maternity roost tree.
- ☐ Removal of suitable trees within 2.5 miles of Indiana bat roost trees or within 5 miles of Indiana bat capture sites.
- ☐ Removal of suitable trees > 2.5 miles from Indiana bat roost trees or > 5 miles from Indiana bat capture sites.
- ☐ Removal of documented Indiana bat or NLEB roost tree, if still suitable.
- ☐ N/A

STEP 8) Presence/absence surveys were/will be conducted: ○ **YES** ◉ **NO** ○ **TBD**

STEP 9) Presence/absence survey results, on _____ ○ **NEGATIVE** ○ **POSITIVE** ◉ **N/A**

STEP 10) Project ◉ **WILL** ○ **WILL NOT** require use of Incidental Take in the amount of 42.89 ◉ **acres or** ○ **trees** proposed to be used during the ■ **WINTER** ○ **VOLANT SEASON** ○ **NON-VOLANT SEASON** ○ **N/A**

STEP 11) Available Incidental Take (prior to accounting for this project) as of Apr 6, 2022

TVA Action	Total 20-year	Winter	Volant Season	Non-Volant Season
5 Operate, Maintain, Retire, Expand, Construct Power Plants	1,661.29	1,248.09	308.74	104.46

STEP 12) Amount contributed to TVA's Bat Conservation Fund upon activity completion: $ 0 OR ◉ **N/A**

TERRESTRIAL ZOOLOGISTS, after completing SECTION 2, review Table 4, modify as needed, and then complete section for Terrestrial Zoologists at end of form.

SECTION 3: REQUIRED CONSERVATION MEASURES

STEP 13) Review Conservation Measures in Table 4 and ensure those selected are relevant to the project. If not, manually override and uncheck irrelevant measures, and explain why in ADDITIONAL NOTES below Table 4.

Did review of Table 4 result in ANY remaining Conservation Measures in **RED**?

○ **NO** (Go to Step 14)

◉ **YES** (STOP HERE; Submit for Terrestrial Zoology Review. Click File/Save As, name form as "ProjectLead_BatForm_CEC-or-ProjectIDNo_Date", and submit with project information).

Table 4. TVA's ESA Section 7 Programmatic Bat Consultation Required Conservation Measures

The Conservation Measures in Table 4 are automatically selected based on your choices in Tables 2 and 3 but can be manually overridden, if necessary. To Manually override, press the button and enter your name.

Manual Override

Name: Elizabeth Hamrick

Check if Applies to Project	Activities Subject To Conservation Measure	Conservation Measure Description
■	15, 16, 17, 18, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 45, 47, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 90, 91, 92, 93, 94, 95, 96	**NV1** - Noise will be short-term, transient, and not significantly different from urban interface or natural events (i.e., thunderstorms) that bats are frequently exposed to when present on the landscape.
■	16, 25, 26, 37, 47, 52, 62, 63, 64, 65, 70, 71, 73, 78, 80, 82, 83, 86, 91	**NV2** - Drilling, blasting, or any other activity that involves continuous noise (i.e., longer than 24 hours) disturbances greater than 75 decibels measured on the A scale (e.g., loud machinery) **within a 0.5 mile radius of documented winter and/or summer roosts** (caves, trees, unconventional roosts) will be conducted when bats are absent from roost sites.
■	16, 26, 62	**NV3** - Drilling or blasting **within a 0.5 mile radius of documented cave** (or unconventional) roosts will be conducted in a manner that will not compromise the structural integrity or alter the karst hydrology of the roost site.
■	16, 26, 62	**NV4** - Drilling or blasting **within 0.5 miles of a documented roost site** (cave, tree, unconventional roost) that needs to occur when bats are present will first involve development of project-specific avoidance or minimization measures in coordination with the USFWS.
■	17, 23, 34	**SHF2** - Site-specific conditions (e.g., acres burned, transport wind speed, mixing heights) will be considered to ensure smoke is limited and adequately dispersed away from caves so that smoke does not enter cave or cave-like structures.
■	17, 23, 34	**SHF4** - If burns need to be conducted during April and May, when there is some potential for bats to present on the landscape and more likely to enter torpor due to colder temperatures, burns will only be conducted if the air temperature is 55° or greater, and preferably 60° or greater.
■	17, 22, 23, 32, 33, 34, 35, 36	**SHF7** - Burning will only occur if site specific conditions (e.g. acres burned, transport wind speed, mixing heights) can be modified to ensure that smoke is adequately dispersed away from caves or cave-like structures. This applies to prescribed burns and burn piles of woody vegetation.
■	17, 22, 23, 32, 33, 34, 35, 36	**SHF8** - Brush piles will be burned a **minimum of 0.25 mile from documented, known, or obvious caves or cave entrances** and otherwise in the center of newly established ROW when proximity to caves on private land is unknown.
■	17, 23, 34	**SHF9** - A **0.25 mile buffer of undisturbed forest** will be maintained around documented or known gray bat maternity and hibernation colony sites, documented or known Virginia big-eared bat maternity, bachelor, or winter colony sites, Indiana bat hibernation sites, and northern long-eared bat hibernation sites. Prohibited activities within this buffer include cutting of overstory vegetation, construction of roads, trails or wildlife openings, and prescribed burning. Exceptions may be made for maintenance of existing roads and existing ROW, or where it is determined that the activity is compatible with species conservation and recovery (e.g., removal of invasive species).
■	33, 34	**TR3*** - Removal of suitable summer roosting habitat within documented bat habitat (i.e., within 10 miles of documented Indiana bat hibernacula, within 5 miles of documented northern long-eared bat hibernacula, within 2.5 miles of documented Indiana bat summer roost trees, within 5 miles of Indiana bat capture sites, within 1 mile of documented northern long-eared bat summer roost trees, within 3 miles of northern long-eared bat capture sites) will be tracked, documented, and included in annual reporting. Project will therefore communicate completion of tree removal to appropriate TVA staff.

■	69, 77, 89, 91	**AR1** - Projects that involve structural modification or demolition of buildings, bridges, and potentially suitable box culverts, will require assessment to determine if structure has characteristics that make it a potentially suitable unconventional bat roost. If so a survey to determine if bats may be present will be conducted. Structural assessment will include: ○ Visual check that includes an exhaustive internal/external inspection of building to look for evidence of bats (e.g., bat droppings, roost entrance/exit holes); this can be done at any time of year, preferably when bats are active. ○ Where accessible and health and safety considerations allow, a survey of roof space for evidence of bats (e.g., droppings, scratch marks, staining, sightings), noting relevant characteristics of internal features that provide potential access points and roosting opportunities. Suitable characteristic may include: gaps between tiles and roof lining, access points via eaves, gaps between timbers or around mortise joints, gaps around top and gable end walls, gaps within roof walling or around tops of chimney breasts, and clean ridge beams. ○ Features with high-medium likelihood of harboring bats but cannot be checked visually include soffits, cavity walls, space between roof covering and roof lining. ○ Applies to box culverts that are at least 5 feet (1.5 meters) tall and with one or more of the following characteristics. Suitable culverts for bat day roosts have the following characteristics: • Location in relatively warm areas • Between 5-10 feet (1.5-3 meters) tall and 300 ft (100 m) or more long • Openings protected from high winds • Not susceptible to flooding • Inner areas relatively dark with roughened walls or ceilings • Crevices, imperfections, or swallow nests ○ Bridge survey protocols will be adapted from the Programmatic Biological Opinion for the Federal Highway Administration (Appendix D of USFWS 2016c, which includes a Bridge Structure Assessment Guidance and a Bridge Structure Assessment Form). ○ Bat surveys usually are NOT needed in the following circumstances: • Domestic garages /sheds with no enclosed roof space (with no ceiling) • Modern flat-roofed buildings • Metal framed and roofed buildings • Buildings where roof space is regularly used (e.g., attic space converted to living space, living space open to rafters) or where all roof space is lit from skylights or windows. Large/tall roof spaces may be dark enough at apex to provide roost space
■	69, 77, 89, 91	**AR2** - Additional bat P/A surveys (e.g., emergence counts) conducted if warranted (i.e., when AR1 indicates that bats may be present).

■	16, 17, 18, 21, 22, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 38, 39, 48, 50, 51, 56, 61, 62, 63, 64, 65, 67, 69, 84, 89	**SSPC1** (**Transmission only**) - Transmission actions and activities will continue to Implement A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities. This focuses on control of sediment and pollutants, including herbicides. Following are key measures: ○ BMPs minimize erosion and prevent/control water pollution in accordance with state-specific construction storm water permits. BMPS are designed to keep soil in place and aid in reducing risk of other pollutants reaching surface waters, wetlands and ground water. BMPs will undertake the following principles: • Plan clearing, grading, and construction to minimize area and duration of soil exposure. • Maintain existing vegetation wherever and whenever possible. • Minimize disturbance of natural contours and drains. • As much as practicable, operate on dry soils when they are least susceptible to structural damage and erosion. • Limit vehicular and equipment traffic in disturbed areas. Keep equipment paths dispersed or designate single traffic flow paths with appropriate road BMPs to manage runoff. • Divert runoff away from disturbed areas. • Provide for dispersal of surface flow that carries sediment into undisturbed surface zones with high infiltration capacity and ground cover conditions. • Prepare drainage ways and outlets to handle concentrated/increased runoff. • Minimize length and steepness of slopes. Interrupt long slopes frequently. • Keep runoff velocities low and/or check flows. • Trap sediment on-site. • Inspect/maintain control measures regularly & after significant rain. • Re-vegetate and mulch disturbed areas as soon as practical. ○ Specific guidelines regarding sensitive resources and buffer zones: • Extra precaution (wider buffers) within SMZs is taken to protect stream banks and water quality for streams, springs, sinkholes, and surrounding habitat. • BMPs are implemented to protect and enhance wetlands. Select use of equipment and seasonal clearing is conducted when needed for rare plants; construction activities are restricted in areas with identified rare plants. • Standard requirements exist to avoid adverse impacts to caves, protected animals, unique/important habitat (e.g., cave buffers, restricted herbicide use, seasonal clearing of suitable habitat).
■	16, 17, 18, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 48, 50, 51, 52, 53, 54, 55, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 70, 71, 73, 76, 77, 78, 80, 81, 82, 83, 86, 87, 88, 89, 90	**SSPC2** - Operations involving chemical/fuel storage or resupply and vehicle servicing will be handled outside of riparian zones (streamside management zones) in a manner to prevent these items from reaching a watercourse. Earthen berms or other effective means are installed to protect stream channel from direct surface runoff. Servicing will be done with care to avoid leakage, spillage, and subsequent stream, wetland, or ground water contamination. Oil waste, filters, other litter will be collected and disposed of properly. Equipment servicing and chemical/fuel storage will be limited to locations greater than 300-ft from sinkholes, fissures, or areas draining into known sinkholes, fissures, or other karst features.

■	16, 17, 18, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 66, 67, 69, 70, 71, 73, 76, 77, 80, 81, 82, 83, 84, 86, 87, 88, 89, 90, 91	**SSPC3** (**Power Plants only**) - Power Plant actions and activities will continue to implement standard environmental practices. These include: o Best Management Practices (BMPs) in accordance with regulations: • Ensure proper disposal of waste, ex: used rags, used oil, empty containers, general trash, dependent on plant policy • Maintain every site with well-equipped spill response kits, included in some heavy equipment • Conduct Quarterly Internal Environmental Field Assessments at each sight • Every project must have an approved work package that contains an environmental checklist that is approved by sight Environmental Health & Safety consultant. • When refueling, vehicle is positioned as close to pump as possible to prevent drips, and overfilling of tank. Hose and nozzle are held in a vertical position to prevent spillage o Construction Site Protection Methods • Sediment basin for runoff - used to trap sediments and temporarily detain runoff on larger construction sites • Storm drain protection device • Check dam to help slow down silt flow • Silt fencing to reduce sediment movement o Storm Water Pollution Prevention (SWPP) Pollution Control Strategies • Minimize storm water contact with disturbed soils at construction site • Protect disturbed soil areas from erosion • Minimize sediment in storm water before discharge • Prevent storm water contact with other pollutants • Construction sites also may be required to have a storm water permit, depending on size of land disturbance (>1ac) o Every site has a Spill Prevention and Control Countermeasures (SPCC) Plan and requires training. Several hundred pieces of equipment often managed at the same time on power generation properties. Goal is to • Minimize fuel and chemical use Ensure proper disposal of waste, ex: used rags, used oil, empty containers, general trash, dependent on plant policy • Maintain every site with well-equipped spill response kits, included in some heavy equipment • Conduct Quarterly Internal Environmental Field Assessments at each sight • Every project must have an approved work package that contains an environmental checklist that is approved by sight Environmental Health & Safety consultant. • When refueling, vehicle is positioned as close to pump as possible to prevent drips, and overfilling of tank. Hose and nozzle are held in a vertical position to prevent spillage o Construction Site Protection Methods • Sediment basin for runoff - used to trap sediments and temporarily detain runoff on larger construction sites • Storm drain protection device • Check dam to help slow down silt flow • Silt fencing to reduce sediment movement o Storm Water Pollution Prevention (SWPP) Pollution Control Strategies • Minimize storm water contact with disturbed soils at construction site • Protect disturbed soil areas from erosion • Minimize sediment in storm water before discharge • Prevent storm water contact with other pollutants • Construction sites also may be required to have a storm water permit, depending on size of land disturbance (>1ac) o Every site has a Spill Prevention and Control Countermeasures (SPCC) Plan and requires training. Several hundred pieces of equipment often managed at the same time on power generation properties. Goal is to minimize fuel and chemical use
■	16, 26, 36, 37, 38, 39, 48, 50, 52, 59, 60, 62, 66, 67, 69, 72, 75, 77, 78, 79, 86	**L1** - Direct temporary lighting away from suitable habitat during the active season.
■	16, 26, 36, 37, 38, 39, 48, 50, 52, 59, 60, 62, 66, 67, 69, 72, 75, 77, 78, 79, 86	**L2** - Evaluate the use of outdoor lighting during the active season and seek to minimize light pollution when installing new or replacing existing permanent lights by angling lights downward or via other light minimization measures (e.g., dimming, directed lighting, motion-sensitive lighting).

[1]Bats addressed in consultation (02/2018), which includes gray bat (listed in 1976), Indiana bat (listed in 1967), northern long-eared bat (listed in 2015), and Virginia big-eared bat (listed in 1979).

Hide All Unchecked Conservation Measures

- (●) HIDE
- ( ) UNHIDE

Hide Table 4 Columns 1 and 2 to Facilitate Clean Copy and Paste

- ( ) HIDE
- (●) UNHIDE

NOTES (additional info from field review, explanation of no impact or removal of conservation measures).

No caves within 3 miles. None observed on site during field reviews. Suitable summer roosting habitat was observed on site during field reviews by TVA biologists.

STEP 14) Save completed form (Click File/Save As, name form as "ProjectLead_BatForm_CEC-or-ProjectIDNo_Date") in project environmental documentation (e.g. CEC, Appendix to EA) AND send a copy of form to batstrategy@tva.gov
Submission of this form indicates that Project Lead/Applicant:

_____ (name) is (or will be made) aware of the requirements below.

- Implementation of conservation measures identified in Table 4 is required to comply with TVA's Endangered Species Act programmatic bat consultation.
- TVA may conduct post-project monitoring to determine if conservation measures were effective in minimizing or avoiding impacts to federally listed bats.

For Use by Terrestrial Zoologist Only

☒ Terrestrial Zoologist acknowledges that Project Lead/Contact (name) Sam Vinson has been informed of any relevant conservation measures and/or provided a copy of this form.

☒ For projects that require use of Take and/or contribution to TVA's Bat Conservation Fund, Terrestrial Zoologist acknowledges that Project Lead/Contact has been informed that project will result in use of Incidental Take 42.89 ◉ ac ○ trees and that use of Take will require $ 0 contribution to TVA's Conservation Fund upon completion of activity (amount entered should be $0 if cleared in winter).

For Terrestrial Zoology Use Only. Finalize and Print to Noneditable PDF.

TENNESSEE
VALLEY
AUTHORITY

400 West Summit Hill Drive, Knoxville, Tennessee 37902

May 3, 2022

Mr. Daniel Elbert
U.S. Fish and Wildlife Service
Tennessee Field Office
446 Neal Street
Cookeville, Tennessee 38501

Dear Mr. Elbert:

TENNESSEE VALLEY AUTHORITY (TVA) – CUMBERLAND FOSSIL PLANT (CUF) RETIREMENT– REQUEST FOR CONCURRENCE – PROJECT CODES 2022-0036113 AND 2022-0036130

In order to address the performance challenges that come with an aging Coal Fleet, TVA is proposing to retire and demolish CUF. To replace the lost generation capacity from one unit and to adapt to a changing generation portfolio, TVA is considering constructing and operating a Combined Cycle gas (CC) plant on the existing CUF Reservation. TVA also proposes to construct a new switchyard at the CC plant site, modify existing transmission connections on the CC plant site, and install fiber-optic ground wire along approximately six miles of existing TVA transmission line (TL). More details about the scope and potential impacts of this project and the other alternatives considered can be found in the draft Environmental Impact Statement (EIS) available online https://www.tva.com/environment/environmental-stewardship/environmental-reviews/nepa-detail/cumberland-fossil-plant-retirement. In the Draft EIS, TVA has identified the CC Plant alternative as its preferred alternative and is initiating the Section 7 consultation for that alternative. A more detailed and updated map of the “action area” for TVA’s preferred alternative is attached (AltA_CC_Impacts_Demo.pdf).

TVA is initiating this consultation for its proposed actions at the existing CUF plant site and the proposed transmission upgrades. Comprehensive field surveys have been conducted on the CUF Site, while desktop reviews have been performed for the areas in which transmission upgrades would be conducted. Since the entire scope of work has not yet been finalized for the transmission upgrades, TVA is taking a conservative approach that assumes the maximum degree of ground disturbance for this type of work. A review of the TVA Regional Natural Heritage database and the U.S. Fish and Wildlife Service Information for Planning and Consultation (IPaC) website identified 19 species listed as federally endangered, threatened, candidate for listing under the Endangered Species Act (ESA), or delisted and monitored under the Act, that have the potential to occur within the counties in which TVA has proposed actions; Cheatham, Davidson, and Stewart Counties, Tennessee. These species include five plants (Braun’s rockcress, leafy prairie-clover, Price’s potato-bean, Pyne’s ground plum, and Short’s bladderpod), seven mussels (Cumberland combshell, orangefoot pimpleback, pink mucket, rabbitsfoot, ring pink, tan riffleshell, and yellow-blossom pearlymussel), one crayfish (Nashville crayfish), one bird (bald eagle), three mammals (gray bat, Indiana bat, and northern long-eared

bat (NLEB)) and one insect (monarch butterfly) that have the potential to occur within Cheatham, Davidson, and Stewart Counties, based on historic range, proximity to known occurrence records, biological characteristics, and/or physiographic characteristics. Additionally, the alligator snapping turtle, a proposed threatened species, has the potential to occur in Davidson and Stewart counties. No federally designated critical habitats for these species are present within or adjacent to the action areas; therefore, no adverse modification of critical habitats would occur.

A comprehensive site survey was conducted by TVA biologists from June – August 2021 to determine whether suitable habitat for federally listed species occurs on the CUF reservation. Approximately 922 ft of perennial stream and 6,317 ft of ephemeral stream are contained within the proposed CC plant site. Potential impacts to the intermittent stream due to re-routing or piping would include loss of instream habitat, increased erosion and siltation, and alteration of stream banks and stream bottoms by heavy equipment. Six wetland complexes totaling approximately 29.4 acres fall within the boundaries of the proposed CC plant site, with an additional 49.7 acres of wetlands falling within the proposed transmission line corridor. During the design of the plant, TVA would avoid and minimize impacts to wetlands as practicable. The proposed CC Plant would have an air-cooled system and would not require water withdrawals from the Cumberland River or other surface waters for plant cooling purposes. Service water would be obtained from potable water sources and not from surface waters on site. Minor discharges from the operation of the proposed CC Plant would require updates to the existing site-specific NPDES permit and would comply with all applicable regulations and permit conditions.

Construction of new TLs on the CUF reservation have the potential to affect surface waters and wetlands. The new TLs will be sited to avoid surface waters and wetlands, to the extent practicable, and any surface water and wetland impacts would be permitted as required. Wells Creek would be spanned by the new, short transmission lines connecting the proposed CC plant to the existing transmission substation and switchyard. Where practicable, structures would not be placed within surface waters or wetlands, and impacts would be minimized by crossing surface waters at a perpendicular angle. Where necessary, wetlands may be converted from forested to scrub-shrub or herbaceous to maintain the transmission line corridor. Approximately 30.5 acres of wetlands were classified as forested during wetlands surveys in 2021, which may be permanently converted to scrub-shrub or emergent wetlands if necessary to assure the safe and reliable operation of the transmission facilities. Stumps, root wads, and root systems of trees in wetland areas cleared for the transmission line would be left in place. With the use of proper best management practices (BMPs), Clean Water Act (CWA) Sections 404 and 401 permitting, and compliance with all federal, state, and local regulations, surface water and wetland impacts are expected to be minor.

TVA's proposed action also includes improvements to the existing barge unloading facility to facilitate equipment/materials delivery. Improvements would consist of grading and creation of dirt/rock ramping to the nose of the barge as well as potential concrete resurfacing and widening. Minor, temporary impacts to the Cumberland River would occur when making upgrades to the barge facilities. Applicable U.S. Army Corps of Engineers Section 404 and

Section 10 permits and TDEC Aquatic Resource Alteration Permit (401 Water Quality Certification) would be obtained for upgrades to the barge facilities and for necessary stream alterations, and the terms and conditions of these permits could require mitigation from the proposed activities. Erosion and sediment control BMPs would be implemented as a condition of an NDPES General Construction Storm Water permit.

Botanical surveys conducted on the CUF reservation in August 2021 did not reveal the presence of any Price's potato bean or any suitable habitat that would support this species. ***TVA has determined that the proposed actions on the CUF reservation would not impact Price's potato-bean.*** The federally listed plants Braun's rockcress, leafy prairie-clover, Price's potato-bean, Pyne's ground plum, and Short's bladderpod have been previously reported from Cheatham and Davidson counties, Tennessee, where the transmission upgrades would be located. However, the TVA Regional Natural Heritage database indicates that none of these species have been previously reported from within five miles of the right-of-way (ROW) where work would occur. A desktop review of the transmission line ROW and surrounding vicinity indicates that the specialized habitat required by these plant species is unlikely to occur in the proposed work areas. In addition, topographic maps and aerial photos indicate that no river bluffs or cedar glades occur within the potential action area. For this reason, ***TVA has determined that the proposed transmission upgrades are not likely to adversely affect (NLAA) Braun's rockcress, leafy prairie-clover, Price's potato-bean, Pyne's ground plum, and Short's bladderpod***. Given that the full scope of the transmission upgrades has not been finalized, TVA cannot perform field surveys for federally listed plants at this time. However, TVA does commit to conducting comprehensive surveys of the proposed work areas once the scope is finalized. In the unlikely event that TVA surveys do locate occupied habitat for federally listed plants, TVA would re-initiate Section 7 consultation with the Service.

The pink mucket and rabbitsfoot both occupy large rivers with sand and gravel substrate. Historical records are known from Stewart County or within a ten-digit Hydrologic Unit Code (HUC) of the proposed actions at CUF. A mussel survey in 2011 in the thermally affected area

of the Cumberland River near CUF yielded no state- or federally protected mussel species. River substrates were categorized as degraded/sub-optimal in the study area with clay as the dominant substrate overlain by silt. The protected mussel species have not been collected in the area in decades and TVA has concluded that they no longer occur in the vicinity of CUF. ***Pink mucket and rabbitsfoot would not be affected by the proposed actions.***

Extirpated or historical records of tan riffleshell, yellow-blossom pearlymussel, and Cumberland combshell are known from Cheatham and Davidson counties. The IPaC query also identified the orangefoot pimpleback, pink mucket, and ring pink mussels as potentially being impacted by the proposed transmission upgrades in Cheatham and Davidson counties. The only potential habitat for all these mussel species in the area of proposed transmission upgrades is the Harpeth River. However, no impacts to the Harpeth River are anticipated in association with the proposed transmission upgrades. In addition, the Harpeth River does not provide suitable habitat for tan riffleshell, yellow-blossom pearlymussel, Cumberland combshell, orangefoot

pimpleback, pink mucket, and ring pink due to heavy degradation experienced by this river in this region. ***Tan riffleshell, yellow-blossom pearlymussel, Cumberland combshell, orangefoot pimpleback, pink mucket, and ring pink would not be impacted by the proposed actions.***

Nashville crayfish does not occur outside of the Mill Creek watershed. Proposed actions do not fall within this watershed. ***Nashville crayfish would not be impacted by the proposed actions.***

A bald eagle nest was active from 2005-2009 near CUF, approximately 0.26 mile west of the CUF settling ponds between two TVA TL ROWs, suggesting habitat in this area is suitable for bald eagle nesting. No bald eagles or nests were observed during the 2021 field surveys despite a thorough search of the previous nesting area. Anecdotal reports from employees at the CUF plant indicate that bald eagles have been sighted flying over and near the project area foraging over the Cumberland River. BMPs would be implemented along Wells Creek and the Cumberland River that help preserve foraging habitats. ***Bald eagle would not be impacted by the proposed actions.***

Several hibernacula for gray bat and Indiana bat are known within ten miles of CUF, the closest of which is approximately 6.7 miles away (Coleman Cave). A hibernacula for northern long-eared bat is known approximately 1.6 miles away from CUF (Richardson Cave). One individual was observed in this cave in 2013. In 2011, prior to site selection for the landfill, mist net surveys performed by Environmental Solutions and Innovations, Inc. (ESI), around the proposed landfill resulted in captures of big brown bat, eastern red bat, evening bat, southeastern bat, and tricolored bat on the CUF plant site near Old Scott Road. A male northern long-eared bat was captured during that same survey effort 0.83 miles from the CUF plant property.

Phase 1 Bat Habitat Assessments were conducted at the CUF using the 2020 Range-Wide Indiana Bat Survey Guidelines for determining presence/absence of Indiana bat and NLEB habitat. No caves or mines were observed on the CUF plant property. No evidence of roosting bats was observed on or under the bridge closest to the proposed demolition. Buildings proposed for demolition may offer suitable roosting habitat if left abandoned for several years; however, none have roosting bats at this time. Forest within the proposed CC plant site and new transmission construction areas consists primarily of fence rows largely comprised of dense, older, hackberry and cedar trees. Some trees have suitable roosting characteristics (exfoliating bark, cracks, or crevices). All of these tree lines were deemed moderately suitable summer roosting habitat for Indiana bat and northern long-eared bat. A small area of highly suitable summer roosting habitat may also be removed. Quality of habitat was determined by diversity of forest structure, size of trees, clutter in the understory, and presence of snags and other suitable roosting trees. Suitable foraging habitat for gray bat, Indiana bat, and northern long-eared bat exists over bodies of water on the industrial portion of plant property, over wetlands and streams in the undeveloped areas, and over Wells Creek and the Cumberland River. Additional foraging habitat for Indiana bat and northern long-eared bat exists over, along,

and through forested areas and fence rows. Up to 35.36 acres of moderate to high quality summer roosting habitat would be removed on the CUF reservation as a result of TVA's proposed activities. Tree removal would occur in winter (November 15 – March 31) to avoid direct impacts to federally listed tree roosting bats.

Prior to demolition, internal survey of the buildings proposed for demolition would occur to ensure no colonies of bats have been established while buildings are inactive. Should bats be observed, avoidance and minimization measures (such as seasonal restrictions) would be put in place and the appropriate state and federal agencies (USFWS, TWRA) would be contacted to ensure compliance.

Proposed transmission upgrades would occur in Cheatham and Davidson counties. Gray bats and NLEB are known from Cheatham County. The closest known gray bat record is approximately 13.0 miles away from the proposed transmission upgrades. The closest known northern long-eared bat record is a hibernacula in Davidson County, approximately 6.5 miles away from the transmission line upgrades. Indiana bats are not known from either Cheatham or Davidson counties. The closest known record of Indiana bat to the transmission upgrades is a hibernacula in Montgomery County approximately 28.0 miles away.

Nine caves are known within three miles of the transmission upgrades. The closest of these is approximately 0.31 miles away. No federally listed bat species are known from any of these caves. A desktop review of the transmission line ROW and surrounding vicinity indicates that suitable summer roosting habitat for Indiana bat and NLEB likely exists along ROW associated with the transmission upgrades. Should existing access roads need to be upgraded or new access roads constructed, a conservative, worst-case estimate indicates that up to three acres of suitable summer roosting bat habitat could be removed for this portion of project work. Foraging habitat and sources of drinking water for gray bat, Indiana bat, and northern long-eared bat likely exist in rivers, streams, and potentially wetlands along the ROW with proposed transmission upgrades. TVA will conduct comprehensive field surveys of the proposed transmission upgrades and any associated access roads once the full scope of the transmission upgrades has been finalized. Should any previously unknown caves or other documented roosting sites be identified during field surveys TVA would reinitiate Section 7 consultation.

The following avoidance and minimization measures would be implemented during transmission upgrades to minimize affects to federally listed bat species:

- Best management practices would be put in place around all water bodies to minimize impacts to hydrology and water quality.

- Suitable summer roosting habitat for Indiana bat and northern long-eared bat would be removed between October 15 and March 15 when bats are not likely to be roosting out on the landscape.

- Drilling or blasting within a 0.5-mile radius of documented cave would be conducted in a manner that would not compromise the structural integrity or alter the karst hydrology of the cave.

Several activities associated with this project (including tree removal, building demolition, and drilling) were addressed in TVA's programmatic consultation with the U.S. Fish and Wildlife Service on routine actions and federally listed bats in accordance with Endangered Species Act Section 7(a)(2), completed in April 2018. For those activities with potential to affect bats, TVA committed to implement specific conservation measures when impacts to federally listed bat species are expected. Relevant conservation measures to this project are listed in the bat strategy form and would be implemented as part of the project. ***Proposed actions may affect and are likely to adversely affect (LAA) Indiana bat and northern long-eared bat. Approximately 38.36 acres of "Take" for suitable bat habitat tree removal during the winter season will be used from TVA's programmatic consultation with USFWS in association with this project. (See attached Notification_CUF_EIS_PwrPlants_TVA-Bat-Strategy_04.04.2022) Proposed action may affect but are not likely to adversely affect (NLAA) gray bat.***

While there are no Section 7 requirements for monarch butterfly as a candidate species, it is identified in IPaC as a species that could occur within the Project Site. Monarch butterflies were not noted during field surveys. The majority of the proposed CC plant site is comprised of disturbed fields with common species including Johnson grass, sericea lespedeza, and other common native and non-native herbaceous species. Areas with proposed transmission construction and upgrades contain existing TVA ROWs which provide a wider variety of herbaceous species, several of which provide suitable foraging habitat for monarchs. Milkweed were not a dominant species observed or recorded on the CUF. Existing ROWs would not be impacted by proposed actions except at discrete locations where new structures may be placed. Forest conversion to herbaceous habitats for new transmission ROWs would be seeded with native grasses and/or noninvasive vegetation which would provide more flowering plants than previously occurred in these areas. ***Proposed actions would not jeopardize the continued existence of the monarch butterfly.***

There is potential for foraging habitat for the alligator snapping turtle to be present in the Cumberland River within the demolition boundary; however, no nesting habitat is likely to fall within this disturbance area. Potentially suitable foraging and nesting habitat in and around Wells Creek also exists. Impacts to surface waters and associated shorelines at the CUF would be minimized by avoidance measures and BMPs described above. No suitable habitat for alligator snapping turtle exists near the proposed transmission upgrades. ***Proposed actions would not jeopardize the continued existence of the alligator snapping turtle.***

In addition to TVA's proposed work on the CUF reservation, the new CC plant would be associated with the construction of approximately 32 miles of a new single, 30-inch diameter natural gas pipeline lateral and associated gas system infrastructure. The pipeline would be designed and developed by Tennessee Gas Pipeline Company, LLC (TGP) and is currently proposed to primarily follow an existing TVA transmission line ROW in Dickson, Houston, and

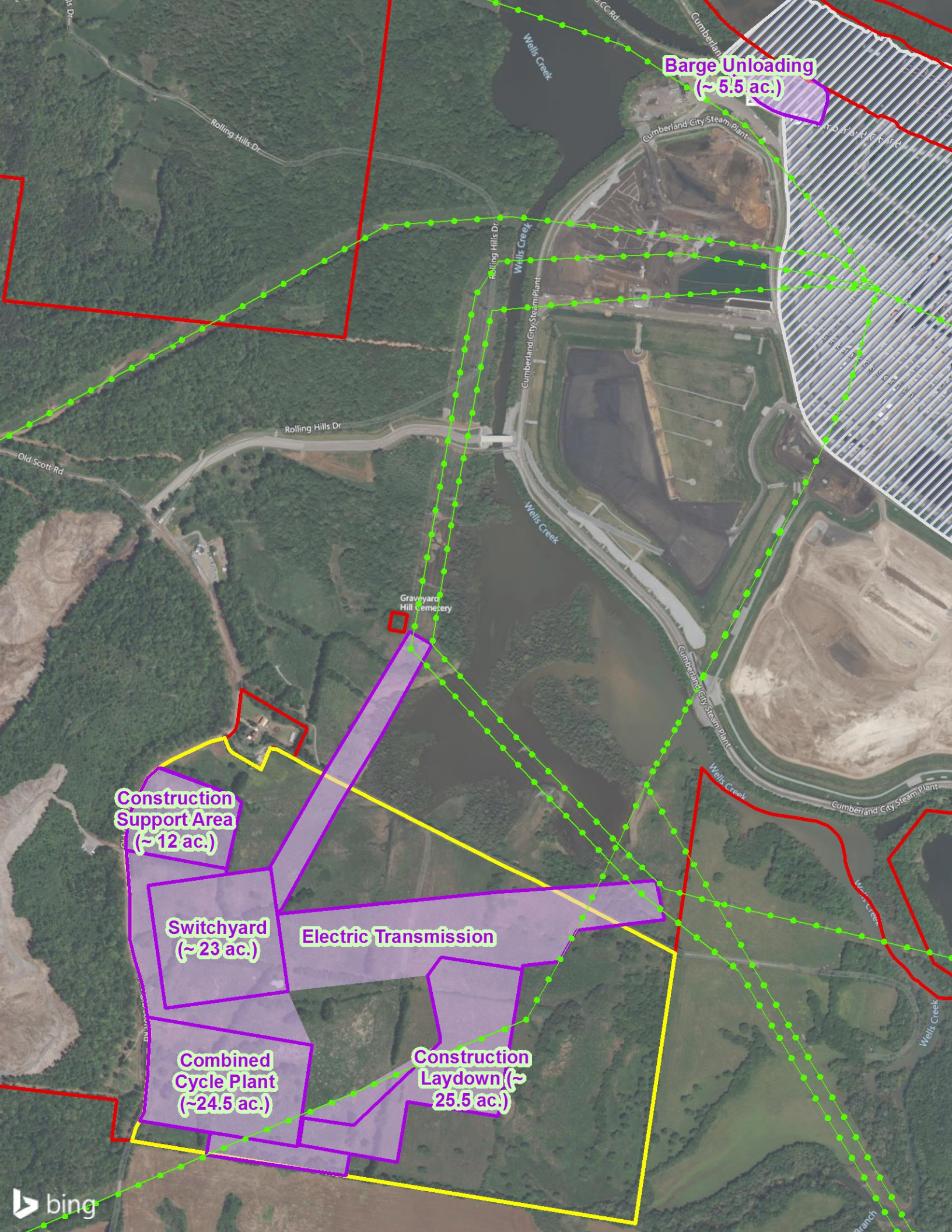
Stewart counties, Tennessee. TGP has submitted a request to use the pre-filing procedures to the Federal Energy Regulatory Commission (FERC) under Docket No. PF22-2-000. On February 17, 2022, TGP, the designated federal representative for FERC, consulted with the US Fish and Wildlife Service under Section 7 of the ESA on actions related to the proposed pipeline and infrastructure. The Service responded to FERC's notice of scoping on March 22, 2022 (FWS #2022-0011291) with concurrence on TGP's ESA Section 7 determinations for the pipeline project. Detailed analysis of the proposed pipeline has been provided by TGP as part of the FERC pre-filing process. TGP's Environmental Report can be found under FERC's Docket No. PF22-2-000. Subject to the completion of FERC's environmental reviews for the pipeline and its issuance of a certificate for the pipeline project, construction of the pipeline is anticipated to begin in August 2024, and the pipeline is anticipated to be operational by September 2025. TVA has proposed to begin removing trees in winter of 2022/2023 and to commence construction of the new CC plant in summer 2023, pending the completion of its NEPA, ESA Section 7, and other environmental reviews for this proposal.

We respectfully request concurrence with TVA's "not likely to adversely affect" determinations for federally listed plants. We also respectfully request acknowledgement of our "no effect" findings and use of "Take" from our 2018 programmatic consultation with the Service regarding impacts of routine actions on federally listed bats. Should you have any questions or wish to discuss the proposed project in more detail, please contact Elizabeth Hamrick by email, ecburton@tva.gov.

Sincerely,

W. Douglas White
Manager
Biological Compliance

EBH:ABM
Enclosures


Barge Unloading
(~ 5.5 ac.)
Wells Creek
Rolling Hills Dr
Cumberland City Steam Plant
Old Scott Rd
Graveyard
Hill Cemetery
Construction
Support Area
(~ 12 ac.)
Switchyard
(~ 23 ac.)
Electric Transmission
Combined
Cycle Plant
(~24.5 ac.)
Construction
Laydown (~
25.5 ac.)
bing

Kay, Jenessa

From: Hamrick, Elizabeth Burton
Sent: Tuesday, October 11, 2022 2:33 PM
To: Pilakowski, Ashley Anne
Subject: FW: [EXTERNAL] Notification - TVA Cumberland Fossil Plant Retirement Project, Cheatham, Davidson, and Stewart Counties

Liz Hamrick
Terrestrial Zoologist
Biological Compliance

TENNESSEE VALLEY AUTHORITY

W. 865-632-4011 **M.** 503-449-2373 **E.** ecburton@tva.gov
400 West Summit Hill Drive, Knoxville, TN 37902

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From: Sykes, Robbie <robbie_sykes@fws.gov> **On Behalf Of** Tennessee ES, FWS
Sent: Friday, August 26, 2022 2:28 PM
To: Hamrick, Elizabeth Burton <ecburton@tva.gov>
Cc: Sykes, Robbie <robbie_sykes@fws.gov>; White, William Douglas <wdwhite0@tva.gov>; McCampbell, Amy Boardman <aboardma@tva.gov>; Pilakowski, Ashley Anne <aapilakowski@tva.gov>; Tennessee ES, FWS <tennesseeES@fws.gov>
Subject: Re: [EXTERNAL] Notification - TVA Cumberland Fossil Plant Retirement Project, Cheatham, Davidson, and Stewart Counties

This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

Ms. Hamrick,

Thank you for the update on the TVA Cumberland Fossil Plant Retirement Project regarding the design changes and minor additions to tree removal estimates at the site. You have indicated that an additional 4.53 acres of potential suitable summer roosting habitat for Indiana bat and northern long-eared bat would be removed at the site. This habitat would be removed between October 15 and March 31 to avoid direct impacts to potentially roosting bats, and these activities were addressed in TVA's programmatic consultation with the U.S. Fish and Wildlife Service on routine actions and federally listed bats in accordance with Endangered Species Act Section 7(a)(2), completed in April 2018.

You have indicated that TVA's effects determinations for federally listed bats have not changed since our previous review of the project in July 2022. Proposed actions may affect and are likely to adversely affect (LAA) Indiana bat and northern long-eared bat. With the above additions, a total of approximately

42.89 acres of "Take" for suitable bat habitat tree removal during the winter season will be used from TVA's programmatic consultation with USFWS in association with this project. The proposed action may affect, but are not likely to adversely affect (NLAA) gray bat.

We acknowledge the design change and additional acreage of "Take" used from the programmatic for the project. Our July 20, 2022 letter (FWS #2022-0036113 & 2022-003613) is still valid for all species determinations associated with this additional acreage.

Sincerely,

Robbie Sykes

From: Hamrick, Elizabeth Burton <ecburton@tva.gov>
Sent: Friday, August 19, 2022 1:48 PM
To: Tennessee ES, FWS <tennesseeES@fws.gov>
Cc: Pelren, David <david_pelren@fws.gov>; Sykes, Robbie <robbie_sykes@fws.gov>; White, William Douglas <wdwhite0@tva.gov>; McCampbell, Amy Boardman <aboardma@tva.gov>; Pilakowski, Ashley Anne <aapilakowski@tva.gov>
Subject: [EXTERNAL] Notification - TVA Cumberland Fossil Plant Retirement Project, Cheatham, Davidson, and Stewart Counties

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

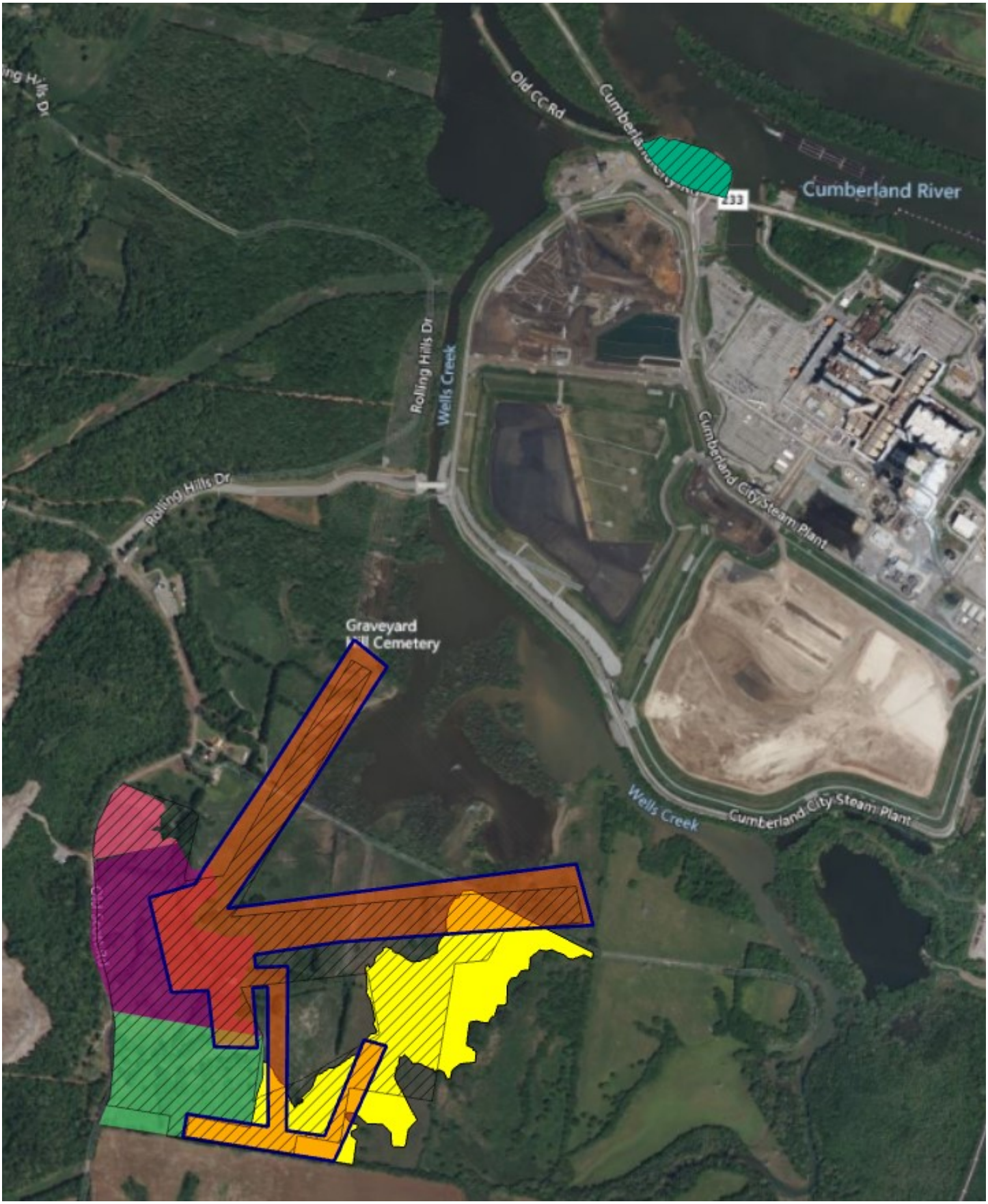
Dear Mr. Elbert:

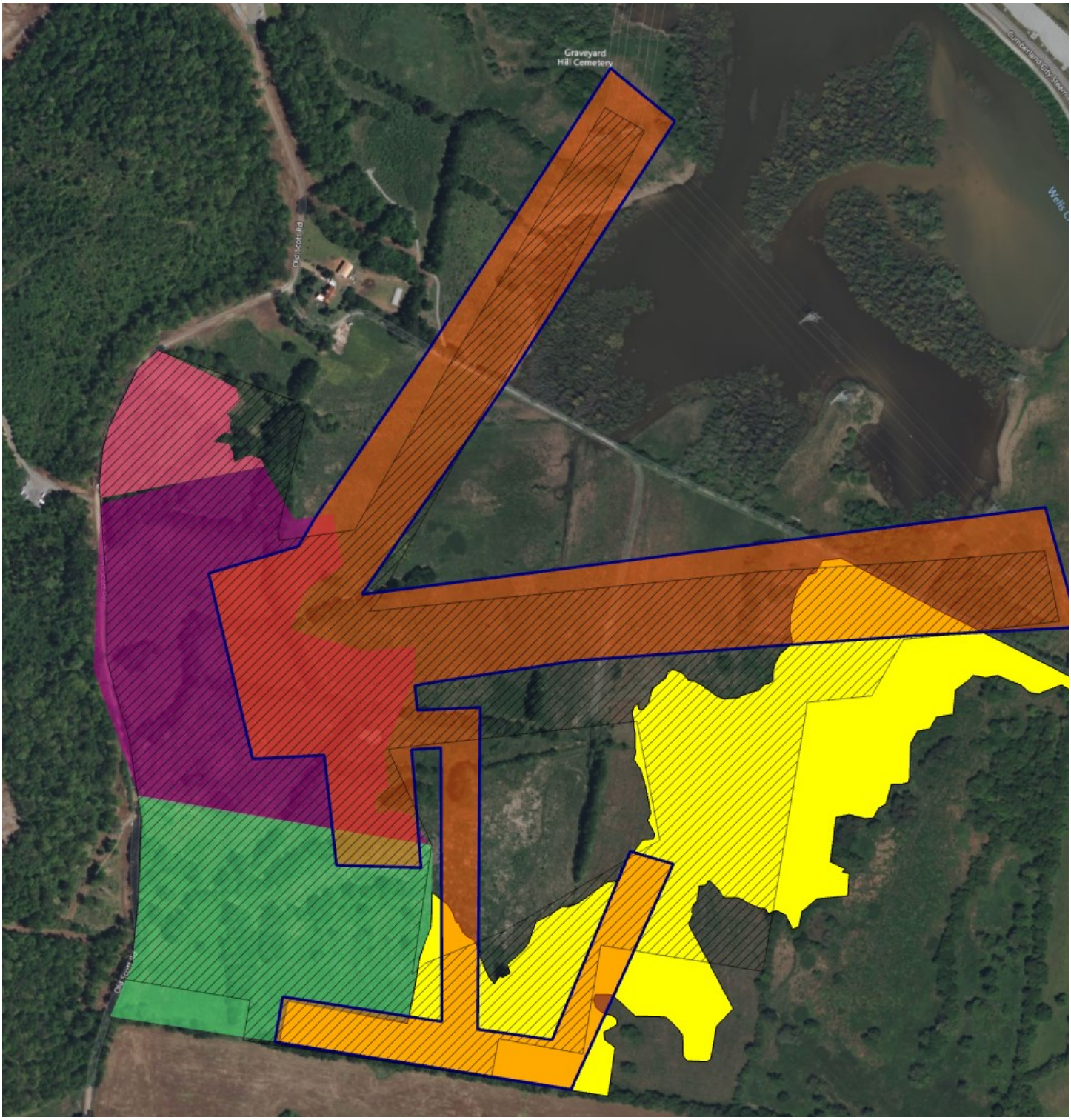
Due to design changes for the TVA Cumberland Fossil Plant Retirement project we have minor additions to our tree removal estimates for this project. The Project Codes are 2022-0036113 and 2022-0036130. TVA received concurrence for our determinations on July 20, 2022.

We have expanded the laydown area on the Cumberland Fossil Plant site. However, we pulled in the construction support area that was located in the upper west corner of the action area at the Cumberland Fossil Plant Site. Images of the old and new Alternative A project action areas are attached. Images below show the old and the new action areas overlayed. Hatched areas represent the old action area previously consulted on with your office.

The design modifications result in the removal of an additional 4.53 acres of potential suitable summer roosting habitat for Indiana bat and northern long-eared bat. This habitat would be removed between October 15 and March 31 to avoid direct impacts to potentially roosting bats. These activities were addressed in TVA's programmatic consultation with the U.S. Fish and Wildlife Service on routine actions and federally listed bats in accordance with Endangered Species Act Section 7(a)(2), completed in April 2018. For those activities with potential to affect bats, TVA committed to implement specific conservation measures when impacts to federally listed bat species are expected. Relevant conservation measures to this project are listed in the updated bat strategy form attached and would be implemented as part of the project.

Our effects determinations for federally listed bats have not changed. ***Proposed actions may affect and are likely to adversely affect (LAA) Indiana bat and northern long-eared bat. With the above additions, a total of approximately 42.89 acres of "Take" for suitable bat habitat tree removal during the winter season will be used from TVA's programmatic consultation with USFWS in association with this project. Proposed action may affect but are not likely to adversely affect (NLAA) gray bat.***


Old CC Rd
Cumberland River
233
Rolling Hills Dr
Wells Creek
Cumberland City Steam Plant
Rolling Hills Dr
Graveyard
Cemetery
Wells Creek
Cumberland City Steam Plant



Liz Hamrick
Terrestrial Zoologist
Biological Compliance

TENNESSEE
VALLEY
AUTHORITY

W. 865-632-4011 **M.** 503-449-2373 **E.** ecburton@tva.gov
400 West Summit Hill Drive, Knoxville, TN 37902

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From: Hamrick, Elizabeth Burton
Sent: Wednesday, May 04, 2022 9:16 AM
To: 'TennesseeES@fws.gov' <TennesseeES@fws.gov>
Cc: 'David Pelren' <david_pelren@fws.gov>; White, William Douglas <wdwhite0@tva.gov>; McCampbell, Amy Boardman <aboardma@tva.gov>; Pilakowski, Ashley Anne <aapilakowski@tva.gov>
Subject: Request for Concurrence - TVA Cumberland Fossil Plant Retirement Project, Cheatham, Davidson, and Stewart Counties

Dear Mr. Elbert:

We respectfully request the review of and concurrence with our determinations regarding impacts to federally listed plants for the proposed Cumberland Fossil Plant Retirement project in Cheatham, Davidson, and Stewart counties, Tennessee. The Project Codes generated through IPaC are 2022-0036113 and 2022-0036130. Please see the attachments in this email for complete informal consultation package. Please don't hesitate to reach out for additional information.

Thank you!

Liz Hamrick
Terrestrial Zoologist
Biological Compliance

TENNESSEE VALLEY AUTHORITY

W. 865-632-4011 **M.** 503-449-2373 **E.** ecburton@tva.gov
400 West Summit Hill Drive, Knoxville, TN 37902

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Appendix M – Cultural Resources Letters of Concurrence

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received 10.24.2012

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

October 24, 2012

Mr. Clinton E. Jones
Tennessee Valley Authority
400 W. Summet Hill Dr.
Knoxville, Tennessee, 37902-1499

RE: TVA, HENRY HOLLISTER HOUSE, UNINCORPORATED, STEWART COUNTY

Dear Mr. Jones:

In response to your request, received on Wednesday, October 17, 2012, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800. You may wish to familiarize yourself with these procedures (Federal Register, December 12, 2000, pages 77698-77739) if you are unsure about the Section 106 process. You may find additional information concerning the Section 106 process and the Tennessee SHPO's documentation requirements at. http://www.tennessee.gov/environment/hist/federal/sect106.shtml

Considering available information, we find that the project as currently proposed will NOT ADVERSELY AFFECT ANY PROPERTY THAT IS ELIGIBLE FOR LISTING IN THE NATIONAL REGISTER OF HISTORIC PLACES. Therefore, this office has no objection to the implementation of this project. Please direct questions and comments to Joe Garrison (615) 532-1550-103.

We appreciate your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jyg

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

November 5, 2012

Mr. Clinton Jones
Tennessee Valley Authority
400 West Summit Hill Drive
WT11D
Knoxville, Tennessee 37902-1499

RE: TVA, PHASE I ARCHAEOLOGICAL ASSESSMENT, CUMBERLAND FOSSIL PLANT/1180 ACRES, UNINCORPORATED, STEWART COUNTY,

Dear Mr. Jones:

At your request, our office has reviewed the above-referenced archaeological survey report in accordance with regulations codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739). Based on the information provided, we concur that the project area contains archaeological resources potentially eligible for listing in the National Register of Historic Places. Sites 40SW63, 40SW219, 40SW702 and 40SW710 should either be avoided by all ground-disturbing activities, or subjected to Phase II archaeological evaluation. The additional 24 sites identified during the survey investigations do not contain resources eligible for inclusion in the National Register, and thus require no additional archaeological investigations.

Upon receipt of the Phase II testing report or avoidance strategy, we will complete our review of this undertaking as expeditiously as possible. Please submit a minimum of two copies of each final report to this office in accordance with the Tennessee Historical Commission Review and Compliance Section Reporting Standards and Guidelines. Complete and/or updated Tennessee Site Survey Forms should be submitted to the Tennessee Division of Archaeology. Until such time as this office has rendered a final comment on this project, your Section 106 obligation under federal law has not been met. Please inform this office if this project is canceled or not permitted or funded by the federal agency. Questions and comments may be directed to Jennifer M. Barnett (615) 741-1588, ext. 105.

Your cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

March 20, 2013

Mr. Clinton Jones
Tennessee Valley Authority
400 West Summit Hill Drive
WT11D
Knoxville, Tennessee 37902-1499

RE: TVA, ARCHAEOLOGICAL ASSESSMENT, CUMBERLAND FOSSIL PLANT/
1180 ACRES, UNINCORPORATED, STEWART COUNTY

Dear Mr. Jones:

At your request, our office has reviewed the above-referenced archaeological survey final report in accordance with regulations codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739). We find that the report meets the Tennessee SHPO Standards and Guidelines For Archaeological Resource Management Studies.

If project plans are changed or archaeological remains are discovered during construction, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act.

Your continued cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

April 1, 2013

Mr. Clinton Jones
Tennessee Valley Authority
400 West Summit Hill Drive
WT11D
Knoxville, Tennessee 37902-1499

RE: TVA, ARCHAEOLOGICAL ASSESSMENT, CUMBERLAND FOSSIL PLANT/
1180 ACRES, UNINCORPORATED, STEWART COUNTY

Dear Mr. Jones:

At your request, our office has reviewed the above-referenced archaeological survey final report in accordance with regulations codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739). We find that the report meets the Tennessee SHPO Standards and Guidelines For Archaeological Resource Management Studies.

If project plans are changed or archaeological remains are discovered during construction, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act.

Your continued cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

May 22, 2013

Mr. E. Patrick McIntyre, Jr.
Executive Director
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), CUMBERLAND FOSSIL PLANT, NATIONAL REGISTER OF HISTORIC PLACES-LISTED HENRY HOLLISTER HOUSE, ARCHITECTURAL AND HISTORICAL DOCUMENTATION, STEWART COUNTY, TENNESSEE

Last year, TVA consulted with your office (letter dated October 16, 2012) concerning our architectural assessment of the Henry Hollister House in Stewart County, Tennessee. The house is listed on the National Register of Historic Places (NRHP) and was acquired by TVA when we purchased 1,254 acres of land for a proposed coal combustion products (CCP) landfill for the Cumberland Fossil Plant (CUF). TVA proposes to dispose of the historic property by selling or transferring it to an interested party. Based on the architectural assessment, TVA determined that the Henry Hollister House remains eligible for listing in the NRHP, and your office agreed by letter dated October 24, 2012. We submitted the final architectural assessment report to your office on November 29, 2012.

Last month, we consulted with your office (letter dated April 18, 2013) concerning a Phase I archaeological survey of the 4.7-acre tract on which the house is located. The survey identified historical archaeological site 40SW723, which is associated with the historic occupation of the Henry Hollister House. TVA has determined that the site is eligible for listing in the NRHP based on criterion (d) of CFR Section 60.4, and your office agreed by letter dated May 2, 2013.

TVA continues to pursue all feasible means of disposing of the Henry Hollister House through sale, or transfer (the “undertaking”), but has not yet finalized plans for disposition.

TVA recently contracted with Tennessee Valley Archaeological Research (TVAR) to conduct additional architectural and historical documentation of the Henry Hollister House, and an inventory of historic artifacts on the property. Enclosed are two copies of the draft report titled *Architectural and Historical Documentation of the NRHP-Listed Henry Hollister House, Stewart County, Tennessee*, along with three CDs containing electronic copies of the report.

By this letter, TVA is inviting your comments on the report and the additional architectural and historical documentation.

Pursuant to 36 CFR Part 800.5, TVA will continue to consult with your office regarding potential effects of selling or transferring the Henry Hollister House to another party.

Should you have any questions or comments, please contact Richard Yarnell in Knoxville at wryarnel@tva.gov or (865) 632-3463.

Sincerely,

Clinton E. Jones
Senior Manager
Biological and Cultural Compliance
Environmental Permits and Compliance

Enclosures
cc (Enclosures):
Mr. Joe Garrison
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

INTERNAL COPIES ONLY, NOT TO BE INCLUDED WITH OUTGOING LETTER:

Brenda Brickhouse, BR 4A-C
James Tipton II, LP 5D-C
David Robinson, LP 5D-C
Khurshid Mehta, WT 6A-K
EDMS, WT CA-K

TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
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OFFICE: (615) 532-1550
www.tnhistoricalcommission.org

June 21, 2017

Mr. Clinton E. Jones
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Cumberland Fossil (CUF) Plant Access Roads and Borrow Area, , Stewart County, TN

Dear Mr. Jones:

Pursuant to your request, this office has reviewed documentation concerning the above-referenced undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicants for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

Based on the information provided, we concur that the project area contains a cultural resource eligible for listing in the National Register of Historic Places. We further concur that the project as currently proposed will not adversely affect the Henry Hollister House.

This office has no objection to the implementation of this project as currently planned. If project plans are changed or previously unevaluated archaeological resources are discovered during project construction, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act. Questions and comments may be directed to Casey Lee (615 253-3163). We appreciate your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/cjl

TENNESSEE HISTORICAL COMMISSION
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June 26, 2017

Mr. Clinton E. Jones
Tennessee Valley Authority
Biological and Cultural Compliance
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Cumberland Fossil Plant, Coal Cumbustion Residual Management, Stewart County, TN

Dear Mr. Jones:

In response to your request, we have reviewed the documents submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicants for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

Considering available information, concur with your agency's definition of the undertaking's area of potential effect no eligible architectural resources will be affected by this undertaking. We further concur that the project as currently proposed will adversely affect National Register Listed site 40SW219, the Brunsoni Furnace. You should continue to consult with our office to resolve the adverse effect through a memorandum of agreement. Please direct questions and comments to Jennifer M. Barnett (615 687-4780). We appreciate your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

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August 10, 2017

Mr. Clinton E. Jones
Tennessee Valley Authority
Biological and Cultural Compliance
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Management of Coal Combustion Residuals from the Cumberland Fossil Plant, 40SW219, Stewart County, TN

Dear Mr. Jones:

At your request, our office has reviewed the Draft Memorandum of Agreement and Data recovery plan for treatment of National Register listed archaeological site 40SW219, The Brunsoni Furnace which will be adversely affected by the proposed management plan for coal combustion residuals from the Cumberland Fossil Plant. This review is a requirement of Section 106 of the National Historic Preservation Act for compliance by the participating federal agency or applicant for federal assistance. Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

We have provided your agency with our requested editorial changes to the draft documents via electronic transmittal. Upon drafting of revised documents, please submit them to our office for additional review and comment. Please direct questions and comments to Jennifer M. Barnett (615-687-4780). We appreciate your cooperation.

Your continued cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

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April 10, 2018

Mr. Clinton E. Jones
Tennessee Valley Authority
Biological and Cultural Compliance
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Cumberland Fossil Plant Dewatering Location, Revised Location, Stewart County, TN

Dear Mr. Jones:

In response to your request, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

After considering the documentation submitted, it is our opinion that there are no National Register of Historic Places listed or eligible properties affected by this undertaking. We have made this determination because either: no National Register listed or eligible Historic Properties exist within the undertaking's area of potential effects, the specific location, size, scope and/or nature of the undertaking and its area of potential effects precluded affects to Historic Properties, the undertaking will not alter any characteristics of an identified eligible or listed Historic Property that qualify the property for listing in the National Register, or it will not alter an eligible Historic Property's location, setting or use. We have no objections to your proceeding with your undertaking.

If your agency proposes any modifications in current project plans or discovers any archaeological remains during the ground disturbance or construction phase, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act. If you are applying for federal funds, license or permit, you should submit this letter as evidence of consultation under Section 106 to the appropriate federal agency, which, in turn, should contact us as required by 36 CFR 800. If you represent a federal agency, you should submit a formal determination of eligibility and effect to us for comment. You may direct questions or comments to Jennifer M. Barnett (615) 687-4780. This office appreciates your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

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April 20, 2018

Mr. Clinton E. Jones
Tennessee Valley Authority
Biological and Cultural Compliance
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Cumberland Fossil Plant, Brunsoni Iron Furnace, 40SW219 Data Recovery, Stewart County, TN

Dear Mr. Jones:

At your request, and in accordance with the the signed memorandum of agreement between our agencies, our office has reviewed the above-referenced revised archaeological data recovery proposal for site 40SW219. This review is a requirement of Section 106 of the National Historic Preservation Act for compliance by the participating federal agency or applicant for federal assistance. Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

Based on the information provided, we concur with the revised data recovery plan and find that it meets the Tennessee State Historic Preservation Office Reporting Standards and/or the Tennessee SHPO Standards and Guidelines for Archaeological Resource Management Studies.

Your continued cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

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April 20, 2018

Mr. Clinton E. Jones
Tennessee Valley Authority
Biological and Cultural Compliance
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Revised Dewatering Location, Cumberland Fossil Plant, , Stewart County, TN

Dear Mr. Jones:

In response to your request, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

After considering the documentation we concur with your agency there are no National Register of Historic Places listed or eligible properties affected by this undertaking. We have made this determination because either: no National Register listed or eligible Historic Properties exist within the undertaking's area of potential effects, the specific location, size, scope and/or nature of the undertaking and its area of potential effects precluded affects to Historic Properties, the undertaking will not alter any characteristics of an identified eligible or listed Historic Property that qualify the property for listing in the National Register, or it will not alter an eligible Historic Property's location, setting or use. We have no objections to your proceeding with your undertaking.

If your agency proposes any modifications in current project plans or discovers any archaeological remains during the ground disturbance or construction phase, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act. You may direct questions or comments to Jennifer M. Barnett (615) 687-4780. This office appreciates your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

TENNESSEE HISTORICAL COMMISSION
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August 9, 2018

Mr. Clinton E. Jones
Tennessee Valley Authority
Biological and Cultural Compliance
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Cumberland Fossil Plant, Brunsoni Iron Furnace, 40SW219 Data Recovery, Stewart County, TN

Dear Mr. Jones:

At your request, our office has reviewed the above-referenced archaeological data recovery report management summary. This review is a requirement of Section 106 of the National Historic Preservation Act for compliance by the participating federal agency or applicant for federal assistance and is included as a stipulation in the signed memorandum of agreement for this undertaking.

We find that the final report meets the stipulation included in the signed memorandum agreement between our offices for this undertaking and look forward to reviewing the full report upon its drafting.

Your continued cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
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December 18, 2018

Mr. Clinton E. Jones
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Cumberland Fossil Plant Waste Water Treatment System, Stewart County, TN

Dear Mr. Jones:

Our office has reviewed the documentation you submitted regarding the above-mentioned undertaking. This review is a requirement of Section 106 of the National Historic Preservation Act for compliance by the participating federal agency or applicant for federal assistance. Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

Your letter states that TVA completed a Cultural Resources Survey of the Cumberland Fossil Plant in 2008 and that the site was determined not eligible. Your letter fails to state whether this report was submitted to our office and if our office concurred with the eligibility assessment. We also have no record in our database that we have concurred with your eligibility assessment. Please provide us with documentation that our office reviewed the 2008 report and concurred with this assessment. You may contact Casey Lee 615-253-3163 with any questions.

Your continued cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/cjl

THE UNIVERSITY OF ALABAMA | University Museums
Office of Archaeological Research

October 23, 2020

Bridget A. Mohr
Staff Archaeologist/Lab Director
Wood.
Environment & Infrastructure Solutions
11003 Bluegrass Parkway Ste 690/540
Louisville, Kentucky 40299
Office: 502-267-0700
Direct: 502-471-2368
www.woodplc.com

Dear Ms. Mohr:

As per your request, this letter is to establish an agreement to provide curation services to Wood. Environment & Infrastructure Solutions on an as-needed basis.

We are recognized by a variety of Federal agencies as a repository meeting the standards in 54 USC §306131 (36 CFR Part 79) and have formal agreements to provide curation under these guidelines to agencies such as the Department of Defense, National Park Service, U.S. Fish and Wildlife Service, U.S. Soil Conservation Service, U.S. Army Corps of Engineers, Tennessee Valley Authority, National Forest Service, etc.

Please be advised that once a year we must be notified of all reports in which we were named as the repository. Project collections must be submitted within one calendar year of completion. Small projects may be compiled for periodic submission. For Alabama, the AHC survey policy specifies which materials must be curated (Administrative Code of Alabama, Chapter 460-X-9). Archaeological documentation must be curated even if no artifacts are recovered. Renewal of this agreement is contingent upon compliance.

We appreciate having the opportunity to assist you with curation services and look forward to working with you.

Sincerely,

Mark Donop

Dr. Mark Donop RPA
Deputy Director

13075 Moundville Archaeological Park | Moundville, AL 35474 | 205-371-2266 | Fax 205-371-2494 |

TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
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March 11, 2021

Mr. Clinton E. Jones
Tennessee Valley Authority
Biological and Cultural Compliance
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Security Fence Installation at Cumberland Fossil Plant (35.6379, -84.8313), Stewart County, TN

Dear Mr. Jones:

Pursuant to your request, this office has reviewed documentation concerning the above-referenced undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicants for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

Based on the information provided, we find that the project area contains the National Register of Historic Places eligible Henry Hollister House. We further find that the project as currently proposed will not adversely affect this historic property.

This office has no objection to the implementation of this project as currently planned. If project plans are changed or previously unevaluated archaeological resources are discovered during project construction, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act. Questions and comments may be directed to Jennifer M. Barnett (615) 687-4780, Jennifer.Barnett@tn.gov . We appreciate your cooperation.

Sincerely,

E. Patrick McIntyre, Jr. JB

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
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April 28, 2022

Mr. James W. Osborne Jr.
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902

RE: TVA / Tennessee Valley Authority, Architecture Review, Retirement of Cumberland Fossil Plant and Replacement of one Generation Unit, CID 80696, Stewart County, TN

Dear Mr. Osborne:

In response to your request, we have reviewed the documents submitted regarding the architecture review for your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicants for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739) .

The Cumberland Fossil Plant (CUF) should have been re-evaluated as the previous eligibility determinations were made before the resource was fifty (50) years old.

We concur that the project as currently proposed will adversely affect the Henry Hollister House. Our office will not comment on the draft Memorandum of Agreement (MOA) attached with your submission as the Advisory Council on Historic Preservation (ACHP) must be notified of the adverse effect and given the opportunity to participate in consultation. Further, the public and potential consulting parties should be afforded the same opportunity.

Please direct questions and comments to Casey Lee (615 253-3163). We appreciate your cooperation.

Sincerely,

for: E. Patrick McIntyre, Jr.
State Historic Preservation Officer

Casey Lee
Historic Preservation Specialist/Coordinator
Section 106 Review and Compliance Program
Tennessee State Historic Preservation Office

TENNESSEE
VALLEY
AUTHORITY
400 West Summit Hill Drive, Knoxville, Tennessee 37902

September 1, 2022

Mr. E. Patrick McIntyre, Jr.
Executive Director
and State Historic Preservation Officer
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), RETIREMENT OF CUMBERLAND FOSSIL PLANT (CUF) AND REPLACEMENT OF ONE GENERATION UNIT, STEWART COUNTY, TENNESSEE: PROPOSED MEMORANDUM OF AGREEMENT (MOA) TO RESOLVE THE UNDERTAKING'S ADVERSE EFFECTS ON THE NATIONAL REGISTER-LISTED HENRY HOLLISTER HOUSE (TVA TRACKING NUMBER – CID 80696)

We have reviewed your comments (provided August 26) on our August 8, 2022, letter regarding our National Register of Historic Places (NRHP) inventory and assessment of CUF, the above-cited undertaking's adverse effects on the NRHP-listed Henry Hollister House, and our proposed MOA for resolution of the adverse effects. We understand that you agree with TVA that CUF is ineligible for inclusion in the NRHP, that the Hollister House remains sufficient integrity for inclusion, and that the undertaking would result in an adverse effect on the Hollister House. Your letter also states that your office will not comment on a draft MOA while an agency's consultation with other consulting parties is ongoing. TVA has consulted with the Advisory Council on Historic Properties (ACHP) and had reached out to the public in various ways concerning the undertaking; however, we neglected to describe these efforts in our last letter. We present those details below.

TVA notified the ACHP of the potential adverse effect through their electronic notification system on May 14, 2022. The ACHP acknowledged receipt of the notification but did not provide a response, which signals they are not interested in participating in the consultation to resolve adverse effects. TVA held a virtual public meeting on May 5, 2022, and two in-person public meetings on May 17, 2022, and May 18, 2022, and in those meetings presented the proposed project to those in attendance. TVA released the Draft Environmental Impact Statement (DEIS) to the public, State and Federal interested parties on April 25, 2022, and a Notice of Availability was published in the Federal Register on April 29, 2022, that provided a 45-day period for public comment (the comment period ended June 13). The DEIS contains a section summarizing TVA's efforts to identify historic properties in the area of potential effects and evaluate potential adverse effects, TVA's consultation with your office and federally recognized Indian tribes on the undertaking, and the basis of TVA's finding of adverse effect. TVA received a total of 770 comments and approximately 930 petition signatures on the DEIS from State and Federal government agencies, non-governmental organizations, and members of the public. TVA has compiled and reviewed all the comments. Other than a comment from Tennessee Department

of Environment and Conservation recommending that TVA continue consultation with your office, none of those comments are concerned with the undertaking's potential effects on historic properties.

TVA also consulted with federally recognized Indian tribes who have an interest in Stewart County, Tennessee regarding this undertaking. TVA initiated consultation by letter dated July 29, 2021 and received responses from The Cherokee Nation and the Chickasaw Nation, both of whom agreed with TVA's proposed phase I archaeological survey. We consulted again with the tribes at the conclusion of the phase I archaeological survey by letter dated April 13, 2022. In that consultation we provided copies of the report and presented TVA's finding that the undertaking would not affect any archaeological sites listed in, or eligible or potentially eligible for listing in, the NRHP. We received responses from the Chickasaw Nation and the Eastern Shawnee Tribe of Oklahoma, both of whom agreed with TVA's finding. No tribe disagreed with the survey or TVA's finding or identified resources of concern in the project's area of potential effects.

Having thus provided the ACHP, federally recognized Indian tribes, and the public (including individuals, non- governmental organizations, local and state governments, and federal agencies) the opportunity to comment on the undertaking and having received no comments expressing concerns about the Henry Hollister House or other historic properties, we are now providing a draft MOA for your review and comment (attached).

As detailed in the draft MOA, TVA proposes the following mitigation measures:

1. Installation of a Tennessee Historical Marker
2. Vegetative screening
3. Updating the NRHP Nomination Form
4. Archival and remote-sensing study of the Graveyard Hill Cemetery

Pursuant to §800.6(b)(1)(iv) we are inviting your comment on a proposed MOA that outlines measures to mitigate the undertaking's potential adverse effects on the Henry Hollister House.

Please contact Steve Cole by email, sccole0@tva.gov with your comments.

Sincerely,

James W. Osborne, Jr.
Manager
Cultural Compliance

SCC:ERB

MEMORANDUM OF AGREEMENT
BETWEEN THE TENNESSEE VALLEY AUTHORITY
AND THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER
REGARDING THE CUMBERLAND FOSSIL PLANT RETIREMENT AND
REPLACEMENT GENERATION PROJECT, STEWART COUNTY, TENNESSEE

(DRAFT FOR REVIEW)

WHEREAS, the Tennessee Valley Authority (TVA) plans to retire and demolish the Cumberland Fossil Plant (CUF) in Stewart County, Tennessee, and, to recover the lost generation capacity of one unit by constructing and operating a combined cycle (CC) generation facility on the Cumberland Reservation ("the Undertaking") (location shown in Appendix A); and

WHEREAS, the project will also require the construction of two new high-voltage transmission lines leading from the new CC facility's switchyard to existing TVA transmission lines on the Cumberland Reservation; and

WHEREAS, pursuant to § 800.4(a)(1), TVA has determined (in consultation with the Tennessee State Historic Preservation Officer, or TNSHPO) that the area of potential effects (APE) for this Undertaking will include the project footprint and areas within a half mile of the proposed new CC units, switchyard, and transmission lines from which those features would be visible; and

WHEREAS, pursuant to § 800.4(a), TVA in 2012 carried out an archaeological survey that identified no archaeological sites within the project footprint, and consulted with TNSHPO and federally recognized Indian tribes regarding the survey, and the consulting parties agreed or did not comment on TVA's determinations; and

WHEREAS, pursuant to § 800.4(a), TVA in 2022 completed an architectural inventory and assessment of CUF and determined that CUF is ineligible for the National Register of Historic Places (NRHP) due to a ~~lack of historic significance and~~ lack of integrity, and consulted with the TNSHPO, who agreed with TVA's determination; and

WHEREAS, TVA has identified one historic property located in the APE, the Henry Hollister House (SW-745) (Hollister House), which was ~~included on~~ the NRHP in 1988, ~~and has determined further that the Graveyard Hill Cemetery should be considered eligible for the NRHP as a contributing element to the Hollister House;~~ and

WHEREAS, TVA has determined, in consultation with TNSHPO, that the undertaking would result in an adverse visual effect on the Henry Hollister House; and

WHEREAS, TVA considered design changes but was not able to identify any that would minimize or avoid the adverse effect on the Hollister House; and

WHEREAS, pursuant to § 800.6(a)(1), TVA has notified the Advisory Council on Historic Preservation ("Council") of the adverse effect finding by providing documentation specified in § 800.11(e), and the Council declined to participate in consultation;

NOW, THEREFORE, TVA and TNSHPO agree that the Undertaking shall be implemented in accordance with the following stipulations to satisfy TVA's responsibility

under Section 106 of the National Historic Preservation Act (NHPA) to mitigate adverse effects on historic properties that result from the Undertaking.

STIPULATIONS

TVA shall ensure that the following stipulations are implemented:

I. MITIGATION OF ADVERSE EFFECTS ON THE HOLLISTER HOUSE

TVA will take the following steps to mitigate the Undertaking's adverse effects.

A. Installation of a Tennessee Historical Marker

1. TVA shall submit a proposal for a historical marker through the Tennessee Historical Commission's (THC's) Historical Markers Program; work with THC staff regarding eligibility of the proposed marker for the program and regarding the marker's location and text; and install the marker, at TVA's expense, in an appropriate location, accessible by the public, near the Hollister House.
2. The historical marker will present a brief narrative of the history and historic significance of the Hollister House.

B. Vegetative screening

1. TVA shall plant landscaping to screen views to the new facilities from the Hollister House.
2. TVA shall create the vegetative screening using various tree species, including native species, and including both deciduous and evergreen species.
3. TVA shall plant the vegetative screening on the south and east sides of the Hollister House, on TVA property (see map in Appendix A of this Agreement).
4. TVA shall maintain the vegetative screening for so long as TVA owns and operates the new CC plant, so that it will provide the visual screen in perpetuity.

C. Updating the Hollister House NRHP Registration Form

1. TVA shall update the Hollister House NRHP Registration Form, which was completed in 1987, with new information detailed in three historic architectural assessments performed between 2012 and 2022.
2. The new information will include details of the history of the property and the associated cemeteries (Brunsoni/Hollister Cemetery and Graveyard Hill Cemetery), additional historic photographs, information on the property's current condition, and the inclusion of a cistern and the Graveyard Hill Cemetery as contributing resources to the property.
3. TVA shall provide the updated form to the THC for review, and upon approval, to the National Park Service.

D. Study of Graveyard Hill Cemetery

1. TVA shall complete a search for documents related to the Graveyard Hill Cemetery and the persons who may be buried there.

2. The archival study shall endeavor to include (but will not necessarily be limited to) the following sources: birth and death certificates, marriage certificates, deeds, census data, records of sales in the slave trade, and obituaries.
3. TVA shall also complete a delineation of the cemetery using one or more remote sensing methods, and shall attempt to identify the boundaries of the cemetery and anomalies that could correspond to graves.
4. TVA shall prepare a report of the investigations and submit them to TNSHPO for review and comment, and provide a final report that addresses any comments received from TNSHPO/THC.

II. SCHEDULE

A. Historical marker

1. TVA shall submit a proposal for the historical marker to the THC Historical Marker program within nine months of execution of this Agreement.
2. TVA shall seek guidance from THC staff, as needed, while preparing the final marker text.
3. The schedule for marker installation will be determined by THC and the marker installation contractor after TVA's proposal is approved.

B. Vegetative screening

1. TVA shall submit a proposed design for the vegetative screening to TNSHPO for review within nine months of the execution of this Agreement.
2. TVA shall provide TNSHPO 30 days for comments on the draft design.
3. TVA shall endeavor to make any requested modifications to the draft screening design within 60 days of receipt of comments from TNSHPO.
4. The schedule for planting will depend on the season that is most appropriate for planting the selected species.
5. TVA shall endeavor to complete all planting by the start date of construction, currently anticipated in July 2023. If it is not feasible to complete the screening before construction starts, TVA shall complete it as soon as possible after that date.

C. Updated NRHP Registration Form

1. TVA shall provide the updated NRHP form to SHPO within one year of execution of this Agreement.
2. TVA shall provide a final copy of the updated NRHP form to the National Park Service within two years of the execution of this Agreement.

D. Graveyard Hill Cemetery study

1. TVA shall complete archival research and field work for the study within one year of the date of execution of this Agreement.
2. TVA shall provide a draft copy of the report to the SHPO within three months of completion of the study.

III. AUTHORITY

The TVA Federal Preservation Officer, or the designee thereof, shall act for TVA in all matters concerning the administration of this agreement.

IV. DURATION

This MOA will be in effect for three (3) years from the date of its execution unless both Signatories mutually agree to extend the duration of the MOA.

V. REPORTING OF UNANTICIPATED EFFECTS

If unanticipated effects on historic properties occur during the Undertaking, TVA shall implement the Plan for Reporting Unanticipated effects included as an Appendix B in this MOA.

VI. DISPUTE RESOLUTION

Should TNSHPO object at any time to any actions proposed herein or to the manner in which the terms of this MOA are implemented, TVA shall consult with TNSHPO to resolve the objection. If TVA determines that the objection cannot be resolved, TVA, or TNSHPO, may seek guidance from the Council pursuant to § 800.2(b)(2). TVA will take into account any Council comment provided in response to such a request, in resolving any such dispute. The Signatories are responsible for carrying out all actions under this MOA that are not the subject of the dispute.

VII. AMENDMENTS

The Signatories to this agreement may agree to amend the terms of this agreement. Any such amendment shall become effective upon its signing by the Signatories, and the final amendment shall thereafter be appended to this agreement.

VIII. TERMINATION

If either Signatory to this MOA determines that the terms cannot be or are not being carried out, that party shall immediately consult with the other party to attempt to develop an amendment in accordance with Stipulation VII of this agreement. If the agreement is not amended within thirty (30) days of the initiation of such consultation (or another time period agreed to by the Signatories), either Signatory may terminate the MOA upon written notification to the other Signatory.

Once the MOA is terminated, and prior to work continuing on the Undertaking, TVA must either (a) execute a new MOA, or (b) request, take into account, and respond to the comments provided by the Council under § 800.7. TVA shall notify TNSHPO as to the course of action TVA will pursue.

If Stipulations I.A. and I.B. have not been implemented within three years from the date of execution, this MOA will be terminated unless all Signatories mutually agree to extend the duration of the MOA.

EXECUTION of this Memorandum of Agreement (MOA) by TVA and the TNSHPO, the submission of documentation and filing of this MOA with the Council, and implementation of its terms evidence that TVA has, in accordance with Section 106 of the National Historic Preservation Act, taken into account the effects of this Undertaking on Historic Properties and afforded the Council an opportunity to comment. TVA will submit a copy of the executed MOA, along with the documentation that is specified in § 800.11(f), to the Council.

SIGNATORY

TENNESSEE VALLEY AUTHORITY

By: _____ Date: _____
Susan Jacks
Federal Preservation Officer

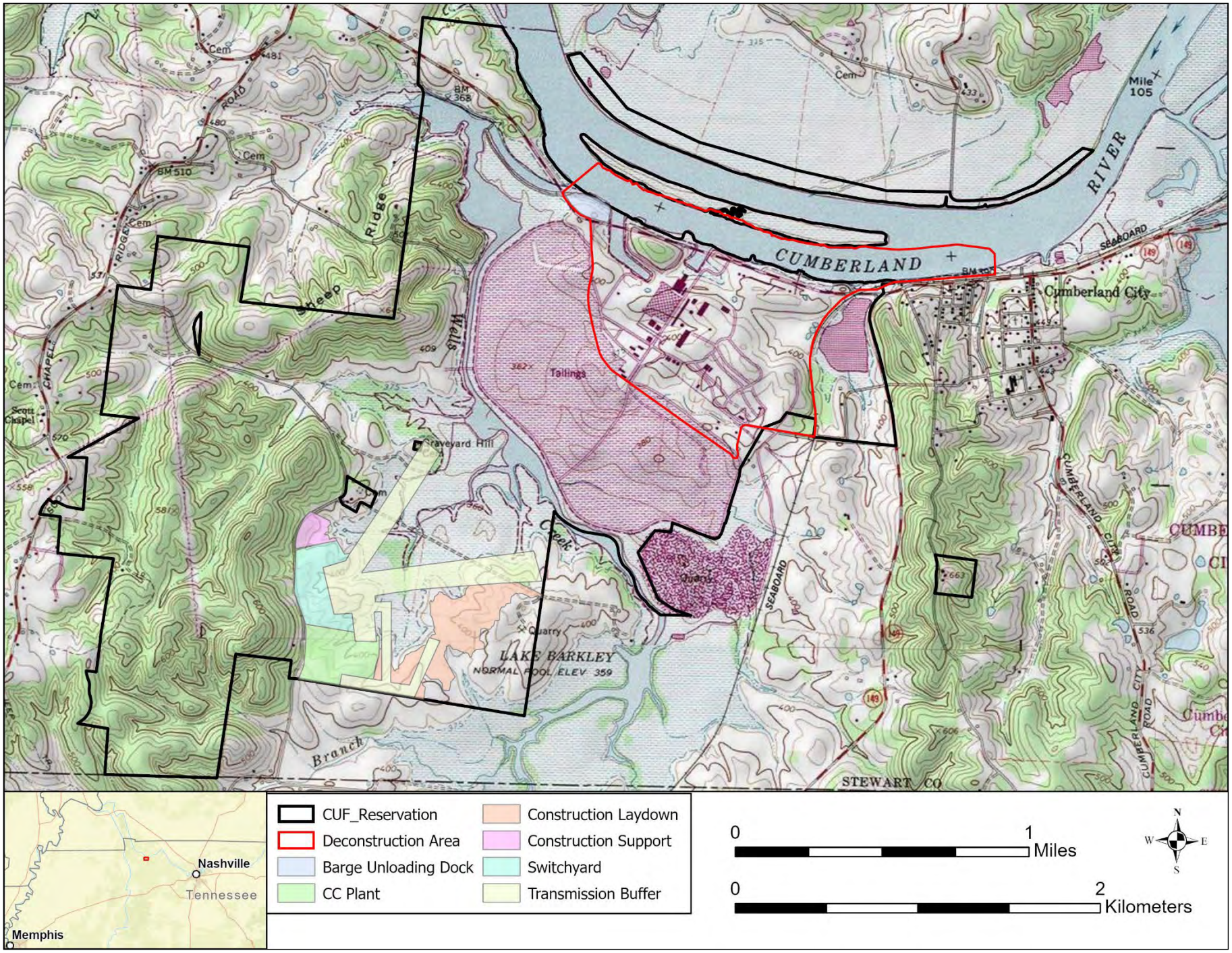
SIGNATORY

THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER

By: _____ Date: _____
E. Patrick McIntyre, Jr., Tennessee State Historic Preservation Officer

Appendix A

Map Showing Location of Undertaking


CUMBERLAND
RIVER
Mile 105
Cumberland City
SEABOARD
Tailings
Quarry
Graveyard Hill
LAKE BARKLEY
NORMAL POOL ELEV 359
Sheep
Ridge
Wells
Creek
Branch
RIDGE ROAD
CHAPEL
Scott Chapel
CUMBERLAND CITY ROAD
STEWART CO
Nashville
Tennessee
Memphis
CUF_Reservation
Deconstruction Area
Barge Unloading Dock
CC Plant
Construction Laydown
Construction Support
Switchyard
Transmission Buffer
0
1
Miles
0
2
Kilometers
N
W
E
S

Appendix B

Map Showing Proposed Location of Vegetation Screen

Maxar, Microsoft
Polygons
Name
Barge Unloading Dock
CC Plant
Construction Laydown
Construction Support
Switchyard
Transmission Buffer
Hollister House SW-745
Proposed vegetation screen
0
300
Feet
0
100
Meters
N
W
E
S

Appendix C

Plan for Reporting Unanticipated Effects

An Unanticipated Effect is any physical damage to any part of an historic property (including as-yet unrecorded archaeological sites that are eligible for inclusion in the National Register of Historic Places, or the Hollister House) that was not foreseen and not expected, that occurs during any activity that is part of the Cumberland Fossil Plant Retirement and Replacement Generation Project (the "Project").

TVA will ensure that on-site personnel responsible for supervising and overseeing the Project are aware of their responsibility to report any Unanticipated Effect, and to do so in a timely manner.

In the event of an Unanticipated Effect, the on-site supervisor or the Principal Engineer overseeing the Project will contact TVA Cultural Compliance immediately. Contact information is provided below.

TVA Cultural Compliance will evaluate whether the Unanticipated Effect constitutes an adverse effect to the historic property. Cultural Compliance staff will utilize whatever methods and means necessary to make this evaluation, and will make the evaluation as expeditiously as possible.

If Cultural Compliance determines that the Unanticipated Effect constitutes an adverse effect to an historic property (pursuant to § 800.5(a)(1)), then TVA will follow the procedures under § 800.13(b)(3) (for resolution of adverse effects that occur after the agency official has completed the Section 106 process without establishing a process to plan for subsequent discoveries):

1. TVA shall notify TNSHPO and the Advisory Council within 48 hours of discovering the Unanticipated Effect. The notification will summarize TVA's earlier determination on the eligibility of the affected property for inclusion for the National Register of Historic Places (NRHP) and will include one or more proposed actions to resolve the adverse effect.

2. TVA will allow 48 hours for TNSHPO and the Advisory Council to respond.

3. TVA shall take into consideration the recommendations of TNSHPO and the Advisory Council regarding the proposed actions and the NRHP eligibility of the property, and shall then carry out appropriate actions.

Contact information:

TVA Business Unit	**Name, title**	**Phone number**	**Email**
Cultural Compliance	Steve Cole, Archaeologist	(865) 824-8450	sccole0@tva.gov
Cultural Compliance	Jim Osborne, Manager	(423) 751-8776	jwosborn@tva.gov

TENNESSEE VALLEY AUTHORITY

400 West Summit Hill Drive, Knoxville, Tennessee 37902

September 19, 2022

Mr. E. Patrick McIntyre, Jr.
Executive Director
and State Historic Preservation Officer
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), RETIREMENT OF CUMBERLAND FOSSIL PLANT AND REPLACEMENT OF ONE GENERATION UNIT, STEWART COUNTY, TENNESSEE: MEMORANDUM OF AGREEMENT (MOA) FOR SIGNATURE (TVA TRACKING NUMBER – CID 80696)

We have reviewed your comments (provided September 6, 2022) on our proposed MOA for resolution of the adverse effects of the above-cited undertaking on the National Register of Historic Places (NRHP)-listed Henry Hollister House. We agree with your suggested revisions. The attached MOA copy reflects those changes, as follows:

- Fifth Whereas clause: Removed “lack of historic significance”;
- Sixth Whereas clause: Replaced “included on” with “listed in”;
- Sixth Whereas clause: Removed phrase beginning, “and has determined further that…”;
- Stipulation I: Moved “Study of Graveyard Hill Cemetery” up as item C, and moved “Updating the Hollister House NRHP Registration Form” down as item D;
- Stipulation I, item D-2: revised and added “and the inclusion of any additional resources that TVA and SHPO agree in consultation are contributing resources to the Hollister House”;
- Stipulation II: Moved “Graveyard Hill Cemetery Study” up as item C, and moved “Updated NRHP Registration Form” down as item D;
- Stipulation II: Revised to reflect that the cemetery study will be performed, and report provided to your office for comment, prior to submitting the NRHP registration form for the Hollister House, in order to allow our offices to reach agreement on contributing resources before the form is submitted. Also modified some of the durations in an effort to have realistic target dates.

We are enclosing a copy of the revised MOA with TVA’s signature and a separate copy of the State Historic Preservation Office signature page. Please sign the page, scan, and send the signed page in digital form. Upon receipt, we will provide a complete copy of the final MOA with both signatures to your office.

Please contact Steve Cole by email, sccole0@tva.gov with your comments.

Sincerely,

James W. Osborne, Jr.
Manager
Cultural Compliance

SCC:ERB
Enclosures

MEMORANDUM OF AGREEMENT
BETWEEN THE TENNESSEE VALLEY AUTHORITY
AND THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER
REGARDING THE CUMBERLAND FOSSIL PLANT RETIREMENT AND
REPLACEMENT GENERATION PROJECT, STEWART COUNTY, TENNESSEE

WHEREAS, the Tennessee Valley Authority (TVA) plans to retire and demolish the Cumberland Fossil Plant (CUF) in Stewart County, Tennessee, and, to recover the lost generation capacity of one unit by constructing and operating a combined cycle (CC) generation facility on the Cumberland Reservation ("the Undertaking") (location shown in Appendix A); and

WHEREAS, the project will also require the construction of two new high-voltage transmission lines leading from the new CC facility's switchyard to existing TVA transmission lines on the Cumberland Reservation; and

WHEREAS, pursuant to § 800.4(a)(1), TVA has determined (in consultation with the Tennessee State Historic Preservation Officer, or SHPO) that the area of potential effects (APE) for this Undertaking will include the project footprint and areas within a half mile of the proposed new CC units, switchyard, and transmission lines from which those features would be visible; and

WHEREAS, pursuant to § 800.4(a), TVA in 2012 carried out an archaeological survey that identified no archaeological sites within the project footprint, and consulted with SHPO and federally recognized Indian tribes regarding the survey, and the consulting parties agreed or did not comment on TVA's determinations; and

WHEREAS, pursuant to § 800.4(a), TVA in 2022 completed an architectural inventory and assessment of CUF and determined that CUF is ineligible for the National Register of Historic Places (NRHP) due to a lack of integrity, and consulted with the SHPO, who agreed with TVA's determination; and

WHEREAS, TVA has identified one historic property located in the APE, the Henry Hollister House (SW-745) (Hollister House), which was listed in the NRHP in 1988; and

WHEREAS, TVA has determined, in consultation with SHPO, that the undertaking would result in an adverse visual effect on the Henry Hollister House; and

WHEREAS, TVA considered design changes but was not able to identify any that would minimize or avoid the adverse effect on the Hollister House; and

WHEREAS, pursuant to § 800.6(a)(1), TVA has notified the Advisory Council on Historic Preservation ("Council") of the adverse effect finding by providing documentation specified in § 800.11(e), and the Council declined to participate in consultation;

NOW, THEREFORE, TVA and SHPO agree that the Undertaking shall be implemented in accordance with the following stipulations to satisfy TVA's responsibility under Section 106 of the National Historic Preservation Act (NHPA) to mitigate adverse effects on historic properties that result from the Undertaking.

STIPULATIONS

TVA shall ensure that the following stipulations are implemented:

I. MITIGATION OF ADVERSE EFFECTS ON THE HOLLISTER HOUSE

TVA will take the following steps to mitigate the Undertaking's adverse effects.

A. Installation of a Tennessee Historical Marker

1. TVA shall submit a proposal for a historical marker through the Tennessee Historical Commission's (THC's) Historical Markers Program; work with THC staff regarding eligibility of the proposed marker for the program and regarding the marker's location and text; and install the marker, at TVA's expense, in an appropriate location, accessible by the public, near the Hollister House.
2. The historical marker will present a brief narrative of the history and historic significance of the Hollister House.

B. Vegetative screening

1. TVA shall plant landscaping to screen views to the new facilities from the Hollister House.
2. TVA shall create the vegetative screening using various tree species, including native species, and including both deciduous and evergreen species.
3. TVA shall plant the vegetative screening on the south and east sides of the Hollister House, on TVA property (see map in Appendix A of this Agreement).
4. TVA shall maintain the vegetative screening for so long as TVA owns and operates the new CC plant, so that it will provide the visual screen in perpetuity.

C. Study of Graveyard Hill Cemetery

1. TVA shall complete a search for documents related to the Graveyard Hill Cemetery and the persons who may be buried there.
2. The archival study shall endeavor to include (but will not necessarily be limited to) the following sources: birth and death certificates, marriage certificates, deeds, census data, records of sales in the slave trade, and obituaries.
3. TVA shall also complete a delineation of the cemetery using one or more remote sensing methods, and shall attempt to identify the boundaries of the cemetery and anomalies that could correspond to graves.
4. TVA shall prepare a report of the investigations and submit them to SHPO for review and comment, and provide a final report that addresses any comments received from SHPO/THC.

D. Updating the Hollister House NRHP Registration Form

1. TVA shall update the Hollister House NRHP Registration Form, which was completed in 1987, with new information detailed in three historic architectural assessments performed between 2012 and 2022.
2. The new information will include details of the history of the property and the associated cemeteries (Brunsoni/Hollister Cemetery and Graveyard Hill Cemetery), additional historic photographs, and information on the property's

current condition, and the inclusion of any additional resources that TVA and SHPO agree in consultation are contributing resources to the Hollister House.

3. TVA shall provide the updated form to the THC for review, and upon approval, to the National Park Service.

II. SCHEDULE

A. Historical marker

1. TVA shall submit a proposal for the historical marker to the THC Historical Marker program within nine months of execution of this Agreement.
2. TVA shall seek guidance from THC staff while preparing the final marker text.
3. The schedule for marker installation will be determined by THC and the marker installation contractor after TVA's proposal is approved.

B. Vegetative screening

1. TVA shall submit a proposed design for the vegetative screening to SHPO for review within nine months of the execution of this Agreement.
2. TVA shall provide SHPO 30 days for comments on the draft design.
3. TVA shall endeavor to make any requested modifications to the draft screening design within 60 days of receipt of comments from SHPO.
4. The schedule for planting will depend on the season that is most appropriate for planting the selected species.
5. TVA shall endeavor to complete all planting by the start date of construction, currently anticipated in July 2023. If it is not feasible to complete the screening before construction starts, TVA shall complete it as soon as possible after that date.

C. Graveyard Hill Cemetery study

1. TVA shall complete archival research and field work for the study within one year of the date of execution of this Agreement.
2. TVA shall provide a draft copy of the report to the SHPO within three months of completion of the study.

D. Updated NRHP Registration Form

1. TVA shall provide the updated NRHP form to SHPO within six months after SHPO provides TVA comments on TVA's report on the Graveyard Hill Cemetery Study.
2. TVA will endeavor to provide a final copy of the updated NRHP form to the National Park Service within 30 months of the execution of this Agreement.

III. AUTHORITY

The TVA Federal Preservation Officer, or the designee thereof, shall act for TVA in all matters concerning the administration of this agreement.

IV. DURATION

This MOA will be in effect for three (3) years from the date of its execution unless both Signatories mutually agree to extend the duration of the MOA.

V. REPORTING OF UNANTICIPATED EFFECTS

If unanticipated effects on historic properties occur during the Undertaking, TVA shall implement the Plan for Reporting Unanticipated effects included as an Appendix B in this MOA.

VI. DISPUTE RESOLUTION

Should SHPO object at any time to any actions proposed herein or to the manner in which the terms of this MOA are implemented, TVA shall consult with SHPO to resolve the objection. If TVA determines that the objection cannot be resolved, TVA, or SHPO, may seek guidance from the Council pursuant to § 800.2(b)(2). TVA will take into account any Council comment provided in response to such a request, in resolving any such dispute. The Signatories are responsible for carrying out all actions under this MOA that are not the subject of the dispute.

VII. AMENDMENTS

The Signatories to this agreement may agree to amend the terms of this agreement. Any such amendment shall become effective upon its signing by the Signatories, and the final amendment shall thereafter be appended to this agreement.

VIII.TERMINATION

If either Signatory to this MOA determines that the terms cannot be or are not being carried out, that party shall immediately consult with the other party to attempt to develop an amendment in accordance with Stipulation VII of this agreement. If the agreement is not amended within thirty (30) days of the initiation of such consultation (or another time period agreed to by the Signatories), either Signatory may terminate the MOA upon written notification to the other Signatory.

Once the MOA is terminated, and prior to work continuing on the Undertaking, TVA must either (a) execute a new MOA, or (b) request, take into account, and respond to the comments provided by the Council under § 800.7. TVA shall notify SHPO as to the course of action TVA will pursue.

If Stipulations I.A. and I.B. have not been implemented within three years from the date of execution, this MOA will be terminated unless all Signatories mutually agree to extend the duration of the MOA.

EXECUTION of this Memorandum of Agreement (MOA) by TVA and the SHPO, the submission of documentation and filing of this MOA with the Council, and implementation of its terms evidence that TVA has, in accordance with Section 106 of the National Historic Preservation Act, taken into account the effects of this Undertaking on Historic Properties and afforded the Council an opportunity to comment. TVA will

submit a copy of the executed MOA, along with the documentation that is specified in § 800.11(f), to the Council.

SIGNATORY

TENNESSEE VALLEY AUTHORITY

By: Susan Jacks _____ Date: 09/16/2022

Susan Jacks
Federal Preservation Officer

SIGNATORY

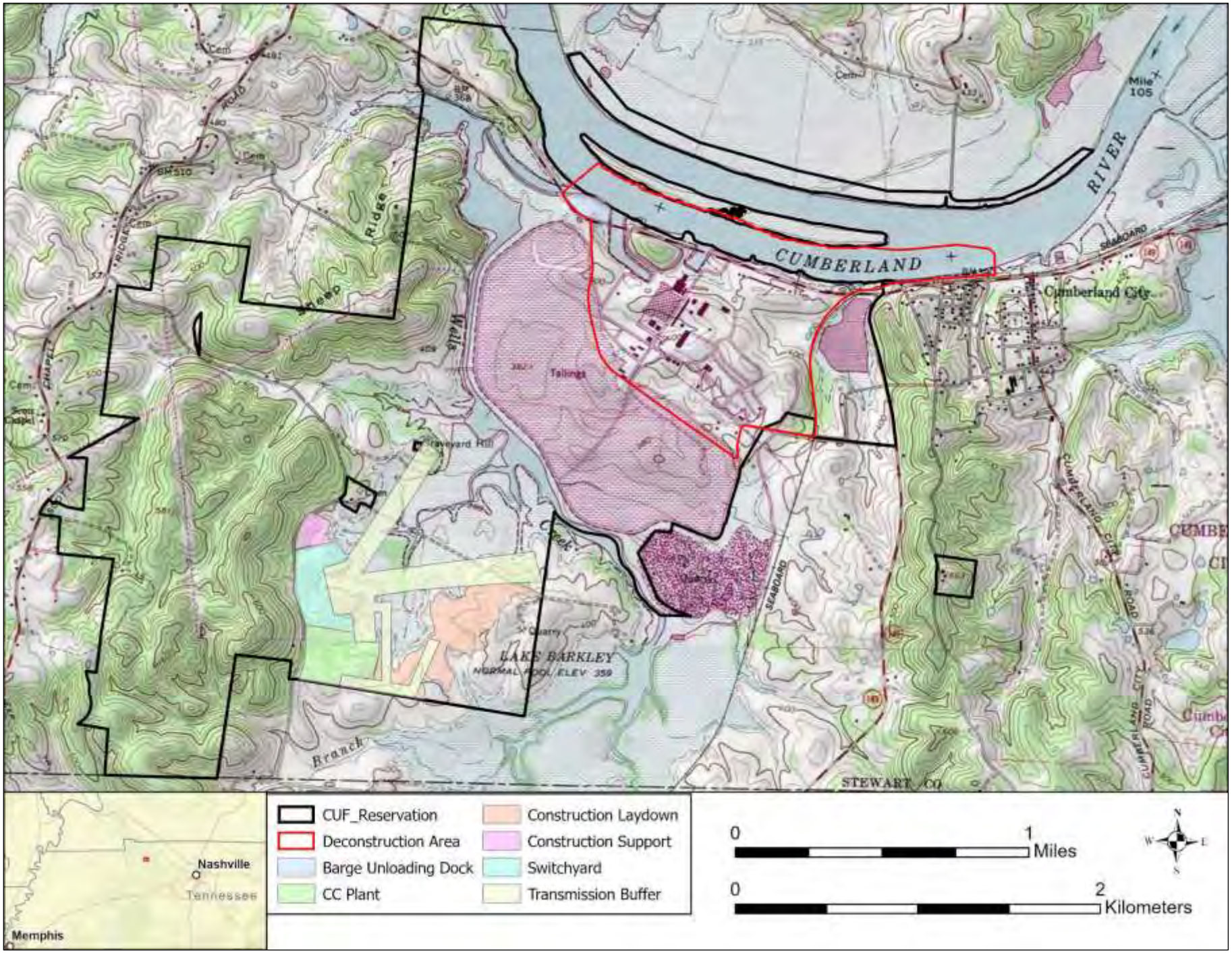
THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER

By:_____ Date: 9/22/2022

E. Patrick McIntyre, Jr.
Tennessee State Historic Preservation Officer

Appendix A

Map Showing Location of Undertaking


CUMBERLAND
RIVER
Mile 105
Cumberland City
Tailings
LAKE BARKLEY
NORMAL POOL ELEV 359
STEWART CO
Nashville
Tennessee
Memphis
CUF_Reservation
Deconstruction Area
Barge Unloading Dock
CC Plant
Construction Laydown
Construction Support
Switchyard
Transmission Buffer
0
1
Miles
0
2
Kilometers

Appendix B

Map Showing Proposed Location of Vegetation Screen

Maxar, Microsoft
Polygons
Name
Barge Unloading Dock
CC Plant
Construction Laydown
Construction Support
Switchyard
Transmission Buffer
Hollister House SW-745
Proposed vegetation screen
0
300
Feet
0
100
Meters
N
W
E
S

Appendix C

Plan for Reporting Unanticipated Effects

An Unanticipated Effect is any physical damage to any part of an historic property (including as-yet unrecorded archaeological sites that are eligible for inclusion in the National Register of Historic Places, or the Hollister House) that was not foreseen and not expected, that occurs during any activity that is part of the Cumberland Fossil Plant Retirement and Replacement Generation Project (the "Project").

TVA will ensure that on-site personnel responsible for supervising and overseeing the Project are aware of their responsibility to report any Unanticipated Effect, and to do so in a timely manner.

In the event of an Unanticipated Effect, the on-site supervisor or the Principal Engineer overseeing the Project will contact TVA Cultural Compliance immediately. Contact information is provided below.

TVA Cultural Compliance will evaluate whether the Unanticipated Effect constitutes an adverse effect to the historic property. Cultural Compliance staff will utilize whatever methods and means necessary to make this evaluation, and will make the evaluation as expeditiously as possible.

If Cultural Compliance determines that the Unanticipated Effect constitutes an adverse effect to an historic property (pursuant to § 800.5(a)(1)), then TVA will follow the procedures under § 800.13(b)(3) (for resolution of adverse effects that occur after the agency official has completed the Section 106 process without establishing a process to plan for subsequent discoveries):

1. TVA shall notify SHPO and the Advisory Council within 48 hours of discovering the Unanticipated Effect. The notification will summarize TVA's earlier determination on the eligibility of the affected property for inclusion for the National Register of Historic Places (NRHP) and will include one or more proposed actions to resolve the adverse effect.

2. TVA will allow 48 hours for SHPO and the Advisory Council to respond.

3. TVA shall take into consideration the recommendations of SHPO and the Advisory Council regarding the proposed actions and the NRHP eligibility of the property, and shall then carry out appropriate actions.

Contact information:

TVA Business Unit	Name, title	Phone number	Email
Cultural Compliance	Steve Cole, Archaeologist	(865) 824-8450	sccole0@tva.gov
Cultural Compliance	Jim Osborne, Manager	(423) 751-8776	jwosborn@tva.gov

Federal Tribes Consulted

Absentee Shawnee Tribe of Indians of Oklahoma

Cherokee Nation

The Chickasaw Nation

Coushatta Tribe of Louisiana

Eastern Band of Cherokee Indians

Eastern Shawnee Tribe of Oklahoma

Jena Band of Choctaw Indians

Kialegee Tribal Town

The Muscogee Nation

The Osage Nation

Shawnee Tribe

Thlopthlocco Tribal Town

and the United Keetoowah Band of Cherokee Indians in Oklahoma.

Appendix N – Burns & McDonnell Preliminary Sound Study: Cumberland Combined Cycle Plant

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Preliminary Sound Study

Tennessee Valley Authority

Cumberland Combined Cycle Plant
Project No. 142943

Revision 1
4/26/2022

Preliminary Sound Study

prepared for

Tennessee Valley Authority
Cumberland Combined Cycle Plant
Cumberland City, Tennessee

Project No. 142943

Revision 1
4/26/2022

prepared by

Burns & McDonnell
Kansas City, Missouri

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3.0 APPLICABLE REGULATIONS 3-1

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
ACC	Air-Cooled Condenser
ANSI	American National Standards Institute
CadnaA	Computer Aided Noise Abatement
dB	decibels
dBA	A-weighted decibels
Existing Facility	Cumberland Fossil Plant
Hz	hertz
ISO	International Organization of Standardization
L_{eq}	equivalent sound level
MP	measurement point
Project	Cumberland Combined Cycle Plant
TVA	Tennessee Valley Authority

REVISION HISTORY

Rev		
0	08-April-2022	Original release
1	26-April-2022	Added text in Section 4 regarding existing sounds and facility operations

1.0 INTRODUCTION

Burns & McDonnell conducted a preliminary sound study for the proposed Cumberland Combined Cycle Plant (Project). The proposed Project consists of two (2) 1x1 combined cycle units to be located to the southwest of the existing Tennessee Valley Authority (TVA) Cumberland Fossil Plant (Existing Facility) in Cumberland City, Tennessee. This preliminary study consists of sound monitoring of the existing environment and predictive sound modeling of the Project to analyze potential offsite sound impacts from operation of the Project.

The objectives of this study are as follows:

- Identify the appropriate standards applicable to the proposed Project;
- Conduct an ambient sound survey in the surrounding community to quantify existing sound levels; and
- Develop a sound model to estimate future sound levels emitted by the proposed Project.

The following chapters describe the study in further detail.

2.0 ACOUSTICAL TERMINOLOGY

The terms “noise level” and “sound level” are often used interchangeably to describe two different sound characteristics called sound power and sound pressure. Every source that produces sound has a sound power level. The sound power level is the acoustical energy emitted by a sound source and is an absolute number that is not affected by the environment. The acoustical energy produced by a source propagates through the air as air pressure fluctuations. These pressure fluctuations, also called sound pressure, are what human ears hear and microphones measure.

Sound energy is physically characterized by amplitude and frequency. Sound amplitude is measured in decibels (dB) as the logarithmic ratio of a sound pressure to a reference sound pressure (20 microPascals). The reference sound pressure corresponds to the typical threshold of human hearing. A 3-dB change in a continuous broadband sound level is generally considered “just barely perceptible” to the average listener. A 5-dB change is generally considered “clearly noticeable,” and a 10-dB change is generally considered a doubling (or halving, if the sound is decreasing) of the apparent loudness.

Frequency is measured in Hertz (Hz), which is the number of cycles per second. The typical human ear can hear frequencies ranging from approximately 20 to 20,000 Hz. Normally, the human ear is most sensitive to sounds in the middle frequencies (1,000 to 8,000 Hz) and is less sensitive to sounds in the low and high frequencies. As such, the A-weighted scale was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighted scale emphasizes sounds in the middle frequencies and de-emphasizes sounds in the low and high frequencies. Any sound level to which the A-weighted scale has been applied is expressed in dBA. For reference, the sound pressure level and subjective loudness associated with some common sound sources are listed in Table 2-1.

Sound in the environment is constantly fluctuating, for example, when a car drives by, a dog barks, or a plane passes overhead. Although an instantaneous sound level measured in dBA may indicate the level of noise experienced by an observer at that point in time, environmental noise levels vary continuously. Most ambient environmental noise includes a mixture of noise from some identifiable sources plus a relatively steady background noise where no particular source is identifiable. A single descriptor called the equivalent sound level (L_{eq}) is used to describe sound that is constant or changing in level. The L_{eq} is the average sound level for a specific time period.

Table 2-1: Typical Sound Pressure Levels Associated with Common Sound Sources

Sound Pressure Level (dBA)	Subjective Evaluation	Environment	
		Outdoor	Indoor
140	Deafening	Jet aircraft at 75 ft.	--
130	Threshold of pain	Jet aircraft during takeoff at a distance of 300 ft.	--
120	Threshold of feeling	Elevated train	Hard rock band
110	--	Jet flyover at 1,000 ft.	Inside propeller plane
100	Very loud	Power mower, motorcycle at 25 ft., auto horn at 10 ft., crowd noise at football game	--
90	--	Propeller plane flyover at 1,000 ft., noisy urban street	Full symphony or band, food blender, noisy factory
80	Moderately loud	Diesel truck (40 mph) at 50 ft.	Inside auto at high speed, garbage disposal
70	Loud	B-757 cabin during flight	Close conversation, vacuum cleaner
60	Moderate	Air-conditioner condenser at 15 ft., near highway traffic	General office
50	Quiet	--	Private office
40	--	Farm field with light breeze, birdcalls	Soft stereo music in residence
30	Very quiet	Quiet residential neighborhood	Bedroom, average residence (without TV and stereo)
20	--	Rustling leaves	Quiet theater, whisper
10	Just audible	--	Human breathing
0	Threshold of hearing	--	--

Sources:
(1) Adapted from *Architectural Acoustics*, M. David Egan, 1988
(2) *Architectural Graphic Standards*, Ramsey and Sleeper, 1994

3.0 APPLICABLE REGULATIONS

No applicable federal, state, or local noise regulations were identified.

4.0 NOISE MONITORING

Noise measurements for the existing ambient and baseline environment were collected using American National Standards Institute (ANSI) S1.4 Type 1 sound level meters (Larson Davis Model 831C). The sound level meters were calibrated at the beginning and end of each set of measurements. Two continuous long-term sound level meters were set up at the measurement locations, labeled MP01 and MP02, shown in Figure A-1 of Appendix A. The coordinates and measurement periods for each sound monitor are shown below in Table 4-1.

Table 4-1: Sound Meter Summary

Meter	Coordinates UTM Meters Zone 16		Start Date	Stop Date
	Easting (m)	Easting (m)		
Meter 1 (MP01)	439,320	4,026,465	03/24/22	03/25/22
Meter 2 (MP02)	439,243	4,025,536	03/24/22	03/25/22

The measured sound levels varied at each monitor location mostly due to variations in nearby activities and background sounds that occurred during each measurement period near the meters.

Sound metrics, inclusive of L_{eq} and octave band data, were collected throughout the monitoring periods. The lowest 1-hour average daytime and nighttime sound level data is provided in Table 4-2.

Table 4-2: Lowest 1-Hour Average Sound Levels

Location	Daytime[a] (Leq dBA)	Nighttime[a] (Leq dBA)
MP01	44	44
MP02	34	32

(a) Daytime is from 7 AM to 10 PM. Nighttime is from 10 PM to 7 AM.

The existing Cumberland Fossil Plant coal-fired units were not operating, and the neighboring landfill had minimal to no activity during the measurement period. Local roadway traffic and naturally occurring sounds were the biggest contributors to measured sound levels.

5.0 PREDICTIVE SOUND MODELING

Burns & McDonnell performed predictive sound modeling for the Project using Computer Aided Noise Abatement (CadnaA), Version 2021, published by DataKustik, Ltd., Munich, Germany. Air absorption, ground absorption, and reflections and shielding for each piece of sound-emitting equipment were considered for predicting downwind sound pressure levels per International Organization for Standardization (ISO) 9613-2, Acoustics – Sound Attenuation during Propagation Outdoors (ISO, 1996).

The ISO standard considers sound propagation and directivity. The sound-modeling software calculates omnidirectional, downwind sound propagation using worst-case directivity factors, in tandem with user-specified directivities and propagation properties. Empirical studies accepted within the industry have demonstrated that modeling may over-predict sound levels in certain directions, and as a result, modeling results generally are considered a conservative measure of the Project's actual sound level.

5.1 Model Inputs

The Project General Arrangement is included as Figure A-2 of Appendix A. The modeled equipment octave-band sound levels assumed for each piece of equipment are included as Appendix B.

Average ground absorption was assumed to be 0.5 for the Project and the land surrounding the Project due to the mix of gravel and soft vegetative surface types. The default meteorological conditions were applied in the model. Each piece of noise-emitting equipment associated with the proposed Project was modeled with the expected sound power levels applied to them. None of the Exiting Facilities sources' sound contributions are included in the model.

5.2 Model Results

The Project will operate at fairly constant sound levels and would not operate in a manner that would generate impulse noise. As such, only steady-state sound level predictions were completed. The predicted overall steady-state operational sound levels, which do not include contributions from ambient sound sources or the Existing Facility, are shown with 5-dB contours in Figure A-3 of Appendix A. The Project sound levels were calculated for MP01 and MP02.

The predicted Project sound levels were logarithmically added to the lowest measured existing condition sound levels at each respective location to estimate the future sound levels near the Project. The lowest hourly sound level at each MP, the predicted Project sound level, and the logarithmic sum are provided in Table 5-1.

Table 5-1: Modeled Sound Levels at Measurement Points

Location	Lowest Measured Hourly Sound Level[a] (dBA)	Model Predicted Project Sound Level[b] (dBA)	Predicted Future Total Sound Level[c] (dBA)
MP01	44	52	53
MP02	32	69	69

(a) Lowest measured hourly sound level
(b) Model predicted Project sound level
(c) Log addition of lowest measured hourly sound level plus the Project's contribution

The Project is expected to contribute a maximum absolute sound level of approximately 52 dBA at MP01 and 69 dBA at MP02. MP01 is located in the vicinity of the nearest noise sensitive receptor and MP02 is located at the southwest corner of the Project site. Project sound levels are primarily influenced by the Air-Cooled Condensers (ACC), which were modeled without mitigation measures applied. Mitigation applied to the ACC could result in a noticeable reduction future offsite sound level.

6.0 CONCLUSION

Burns & McDonnell conducted a preliminary sound study for the proposed Project. This preliminary study consists of sound monitoring of the existing environment and predictive sound modeling of the Project to analyze potential offsite sound impacts from operation of the Project.

The Project is expected to contribute a maximum absolute sound level of approximately 52 dBA at MP01 and 69 dBA at MP02. MP01 is located in the vicinity of the nearest noise sensitive receptor and MP02 is located at the southwest corner of the Project site. Sound impacts will increase the existing sound levels in the area. If necessary, mitigation measures can be applied to Project noise sources that will result in reductions in the offsite sound level impacts.

APPENDIX A - FIGURES

Path: Z:\Clients\ENS\TVA\142943_CCandAeroNoise\Studies\Mod umberland\GIS\TVA Cumb oject\TVA Cumber Project.aprx rjgurreri
Service Layer Credits: World Boundaries and Places: Esri, HERE n, GeoTechnologies, Inc.

Measurement Point (MP)

Project Structures

800 400 0 800

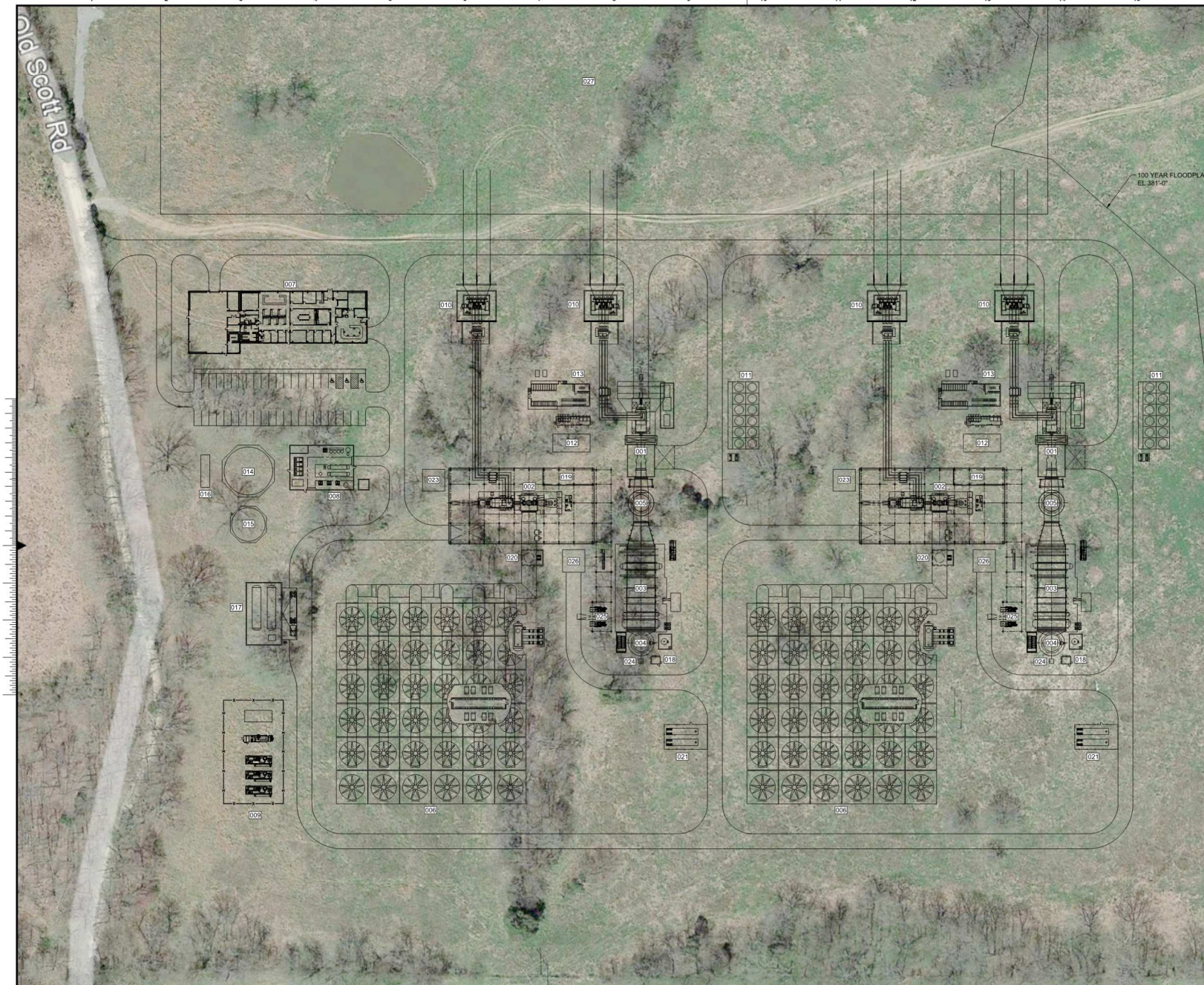
Scale in Feet

BURNS McDONNELL

Figure A-1
TVA
Cumberland
Monitoring Locations

Source: ESRI, Burns & McDonnell

Issued: 4/7/2022



EQUIPMENT IDENTIFICATION AND LOCATION LIST	
DWG REF	DESCRIPTION
001	GAS TURBINE GENERATOR (GTG)
002	STEAM TURBINE GENERATOR (STG)
003	HEAT RECOVERY STEAM GENERATOR (HRSG)
004	HRSG STACK
005	HRSG BYPASS STACK
006	AIR COOLED CONDENSER (ACC)
007	ADMIN BUILDING / CONTROL ROOM / WAREHOUSE
008	WATER TREATMENT BUILDING
009	GAS COMPRESSION, METERING, AND REGULATION
010	GENERATOR STEP-UP TRANSFORMER (GSU)
011	AIR COOLED HEAT EXCHANGER (ACHE)
012	GTG ELECTRICAL PCM
013	BOP ELECTRICAL PCM
014	SERVICE WATER / FIRE WATER STORAGE TANK
015	DEMINERALIZED WATER STORAGE TANK
016	FIRE WATER PUMP ENCLOSURE
017	AMMONIA STORAGE AND UNLOADING
018	CONTINUOUS EMISSIONS MONITORING SYSTEM (CEMS)
019	ELECTRICAL ROOM
020	ACC DRAIN POT, SUMP, AND PUMPS
021	COMPRESSED GAS STORAGE
022	HRSG SKYBRIDGE
023	AUXILIARY BOILER
024	HRSG ELEVATOR
025	BOILER FEED PUMPS
026	TOWER CRANE PAD
027	SWITCHYARD
028	
029	
030	
031	
032	
033	
034	
035	
036	
037	
038	
039	
040	

Figure A-2

PRELIMINARY - NOT FOR CONSTRUCTION

no.	date	by	ckd	description
A	1/12/22	KJK		ISSUED FOR REVIEW

no.	date	by	ckd	description

TRUE NORTH
~7.73°
PLAN NORTH
NORTH

0 50' 100'
SCALE IN FEET

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
Burns & McDonnell Engineering Co, Inc.

designed: D. HOLLAND
detailed: K. KOCH

TVA
TENNESSEE VALLEY AUTHORITY
STEWART COUNTY, TN

CUMBERLAND FOSSIL PLANT
2 1X1 MULTI SHAFT COMBINED CYCLE
GENERAL ARRANGEMENT

project: 139574
contract:
drawing: GA004
rev.: A
sheet 1 of 1 sheets
file 139574_GA001.dwg

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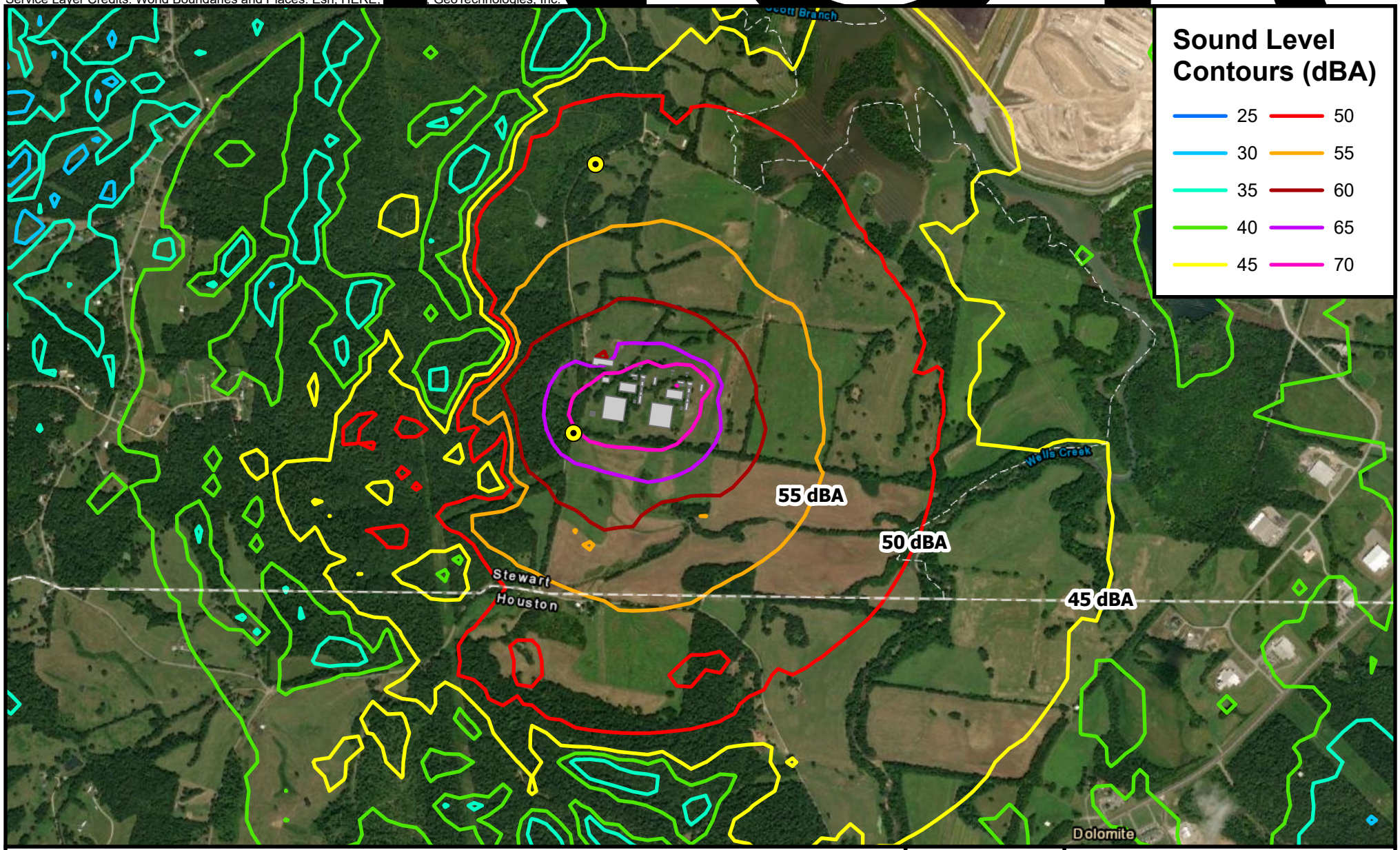
Service Layer Credits: World Boundaries and Places: Esri, HERE, [illegible], GeoTechnologies, Inc.



Measurement Point (MP)

Project Structures

1,500 750 0 1,500

Scale in Feet

BURNS McDONNELL

Figure A-3
TVA
Cumberland
Sound Level Contours

Source: ESRI, Burns & McDonnell

Issued: 4/8/2022

APPENDIX B - MODELED SOUND POWER LEVELS

Equipment Description	Number of Sources	Model Inputs - Source Sound Power Levels (dBA)										Source / BMCD Comments
		Octave Band Center Frequency (Hz)									Overall dBA	
		31.5	63	125	250	500	1000	2000	4000	8000		
Exhaust Diffuser	2	107	114	98	94	88	85	87	89	76	95	Estimate J-Class
GT	2	106	103	101	95	96	97	100	106	94	109	Estimate J-Class
GT Air Inlet Duct DS	2	102	94	88	80	79	80	96	95	72	100	Estimate J-Class
GT Air Inlet Housing	2	110	98	91	78	69	65	68	82	69	84	Estimate J-Class
GT Inlet Duct	2	105	97	91	83	82	83	99	98	75	103	Estimate J-Class
GT Inlet Face	2	112	105	101	94	90	91	96	104	95	106	Estimate J-Class
GT Inlet House	2	102	90	83	70	61	57	60	74	61	77	Estimate J-Class
GT Inlet Plenum	2	102	99	98	93	94	97	97	94	89	102	Estimate J-Class
GTG	2	99	105	107	96	102	100	100	94	84	106	Estimate J-Class
HRSG Body	2	121	114	110	95	93	91	89	88	70	99	Estimate J-Class
HRSG Inlet	2	120	115	114	106	96	96	94	93	75	104	Estimate J-Class
Stack Casing	2	118	114	104	89	73	64	52	39	12	92	Estimate J-Class
HRSG Stack	2	131	123	111	97	87	82	80	76	56	100	Estimate J-Class
Lube Oil Skid	2	101	102	99	98	97	96	96	97	88	103	Estimate J-Class
Turbine Compartment Vent Fans	8	102	102	110	101	98	95	94	98	95	104	Estimate J-Class
STG Building	2	128	125	116	108	97	89	76	71	61	105	Estimate IMP Construction
STG Building Vent	20	95	96	92	89	88	87	86	85	81	93	BMCD Estimate 85 dBA at 3 feet

Equipment Description	Number of Sources	Model Inputs - Source Sound Power Levels (dB)										Source / BMCD Comments
		Octave Band Center Frequency (Hz)									Overall dBA	
		31.5	63	125	250	500	1000	2000	4000	8000		
ACC	2	123	126	126	122	119	116	109	105	101	121	BMCD Estimate 65 dBA at 400 feet
Ammonia Skid	2	91	98	94	91	92	92	90	87	82	97	BMCD Estimate 85 dBA at 3 feet
Aux Trans	2	99	99	103	103	103	87	82	75	70	101	BMCD Estimate
Boiler Feed Pump	4	92	98	96	90	91	100	98	94	84	104	BMCD Estimate 85 dBA at 3 feet
Condensate Recirculation Pumps	4	85	99	94	92	92	91	91	86	84	97	BMCD Estimate 85 dBA at 3 feet
Cooling Water Pump	4	85	99	94	92	92	91	91	86	84	97	BMCD Estimate 85 dBA at 3 feet
Demin Pump	1	85	99	94	92	92	91	91	86	84	97	BMCD Estimate 85 dBA at 3 feet
Fin Fan Coolers	2	87	113	112	109	104	102	96	90	84	107	BMCD Estimate
Fuel Gas Heater	2	104	100	89	81	80	86	88	91	89	96	BMCD Estimate 85 dBA at 3 feet
Gas Compressor	3	--	91	99	100	102	108	104	102	91	111	BMCD Estimate 90 dBA at 3 feet
Gas Compressor Cooler	3	80	106	105	102	97	95	89	83	77	100	BMCD Estimate 85 dBA at 3 feet
GSU Trans	2	105	105	109	109	109	93	88	81	76	107	BMCD Estimate
HP Fuel Gas Skid	1	104	100	89	81	80	86	88	91	89	96	BMCD Estimate 85 dBA at 3 feet
HRSG BDVT	2	85	93	101	105	102	99	95	91	69	104	BMCD Estimate
HRSG Vent	4	80	88	96	100	97	94	90	86	64	99	BMCD Estimate
LP Fuel Gas Skid	1	104	100	89	81	80	86	88	91	89	96	BMCD Estimate 85 dBA at 3 feet
Service Water Pump	1	85	99	94	92	92	91	91	86	84	97	BMCD Estimate 85 dBA at 3 feet
Steam Trunk	2	111	108	101	96	92	89	105	86	75	107	BMCD Estimate

CREATE AMAZING.

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Appendix O – Responses to Public Comments on the Draft EIS

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APPENDIX O – RESPONSES TO PUBLIC COMMENTS ON THE DRAFT EIS

A. Introduction

A draft of this environmental impact statement (EIS) was released for public comment on April 25, 2022. The Environmental Protection Agency (EPA) Notice of Availability of the Draft EIS was posted in the Federal Register on April 29, 2022; and the comment period closed on June 13, 2022. The Draft EIS was transmitted to state, federal, and local agencies and federally recognized tribes. It also was posted on TVA's public NEPA review website. Notice of availability of the draft and the request for comments was published in newspapers serving the Cumberland Fossil Plant (CUF) area. Notification letters were provided with the Highland Rim Economic Corporation commodity distribution event. Coloring books that contained fact sheets and information about the project were sent home with children who attend schools local to CUF. Postcards were sent to households within a 3-mile radius of CUF. Email notifications of the availability of the Draft EIS were sent to people who had previously requested notifications. TVA held three public meetings, one virtual and two in-person. TVA accepted comments through an electronic comment form on the project website, by mail, and by email. Comments received during public meetings were also accepted.

TVA received 770 comments and 930 signatures on the Draft EIS; most of these generally support the retirement of the CUF coal-fired generating units but opposed Alternative A, Alternative B, or both. About three-fourths of these comments were submitted through the web-based comment form. Several form emails generated by multiple environmental groups were also submitted including the Clean Up TVA Coalition, Sierra Club, Southern Environmental Law Center (SELC), and Southern Alliance for Clean Energy (SACE). A few comments were received on subjects outside the scope of the Draft EIS, such as health insurance and pensions for retired plant workers. These are not included in this report. TVA also received two late comments regarding the Inflation Reduction Act of 2022, which was enacted after conclusion of the Draft EIS public comment period. Although these comments were received after the public comment period had closed, TVA addresses the Inflation Reduction Act of 2022 as it relates to this action in responses below.

A few of the comments stated a broad support for the continued use of coal to generate electricity; these were interpreted as supporting the No Action Alternative, under which TVA would continue to generate electricity with the existing CUF coal-fired units. Comments were received from two federal agencies (U.S. Environmental Protection Agency [USEPA] and National Park Service [NPS]) and two state agencies (Tennessee Department of Environment and Conservation [TDEC] and Tennessee Department of Transportation [TDOT]). A list of commenters and their affiliation is provided in Part C of this appendix. Comment letters from state and federal agencies and from environmental groups are provided in Part D of this appendix.

TVA carefully reviewed all of the substantive comments that it received. Many of the individual comments were similar in substance. To avoid repetition, TVA grouped similar comments and produced one synthesized response for each comment grouping. The commenters contributing to each synthesized comment are listed in Part B of this appendix. Because TVA worked to retain nuances among comments, a number of synthesized comments are similar and likely overlap. The result of this analysis and synthesis process is the list of 118 substantive comments to which TVA has provided responses in this appendix. Part C provides a list of

commentors, their affiliation, and the identification numbers of the comments address their submitted comments.

This EIS tiers from TVA's 2019 Integrated Resources Plan (IRP) EIS. For the IRP EIS process, TVA provided numerous opportunities for public review and comment, including two formal comment periods, nine public meetings, and several webcasts during which participants could make comments and ask questions. TVA implemented a social media strategy to spread more awareness of the IRP and public participation opportunities, advertised in multiple newspapers, and provided various media releases. See Chapter 3 of the 2019 IRP for additional information.

B. Response to Comments

PURPOSE AND NEED

1. The EIS must consider a broader suite of alternatives and compare their relative environmental impacts. Once the purpose and need for the EIS is properly defined, it becomes apparent that TVA has improperly refused to consider reasonable alternatives. The purpose of NEPA is to identify reasonable alternatives to an agency's proposed action, and then expose and discuss the multitude of public health, environmental, socioeconomic, wildlife, and other impacts of those alternatives. However, regardless of the ultimate decisions made, NEPA does not permit an agency to refuse to even consider reasonable alternatives. See, e.g., Nat'l Wildlife Fed'n v. Nat'l Marine Fisheries Serv., 235 F. Supp. 2d 1143, 1154 (W.D. Wash. 2002) ("An agency may not reject a reasonable alternative because it is not within the jurisdiction of the lead agency"). Accordingly, here TVA may not rely on contract terms or simple economic considerations to refuse to consider alternative scenarios for its power mix in the coming decades, including DER [distributed energy resources] and storage alternatives. Once again, this is particularly true given TVA's statutory mission be a "leader in technology innovation, low-cost power and environmental stewardship." 16 U.S.C. § 831a(b)(5). To meet this mandate TVA must explore opportunities to invest in the renewable energy technologies that will help reduce electricity prices and make those technologies even more cost-competitive in the coming years. Indeed, recent research demonstrates that replacing fossil fuel resources with DER, storage, and energy efficiency could provide significant financial benefits. In addition to cost savings, DERs bring several additional benefits including grid management, demand response, and transmission benefits.

TVA has expressed concern that alternatives prioritizing renewables like solar as replacements to Cumberland are incapable of addressing peak demand. But as the Vibrant Clean Energy report demonstrates, DER can minimize peak demand by about 17 percent and effectively shift demand to meet variable supply rather than forcing supply to meet demand. Additionally, distributed solar generation can provide benefits to communities and ecosystems including reduced water use, reduced land use, and even improved wildlife habitat, which are critically important to TVA's customers.

In the Draft EIS, one of TVA's arguments against the renewable alternative was the estimated 22,540 acres of land that would be converted from agricultural to industrial to accommodate 4,700 MW of new solar and storage in Middle Tennessee. However, this concern is irrelevant to the kinds of DER, energy efficiency, and related initiatives we proposed in our scoping comments, which TVA has thus far rejected out of hand. In particular, alternatives with distributed energy, storage and energy efficiency could address this concern while also reducing demand for large-scale energy projects like fossil gas that carry significant environmental, community, and public health hazards.

TVA must consider a full range of renewable energy alternatives, including an alternative that largely or completely relies on DER, storage, and energy efficiency, and then must

compare the environmental impacts of such alternatives with the other options - including not only the cost of potential early retirement of fossil fuel resources and expansion of gas, but also the social cost of carbon associated with keeping them running for many years to come. In short, to meet its purpose of providing safe, clean, reliable, and affordable electricity to all its customers, TVA must consider alternatives that focus on DER, storage, and energy efficiency as replacements for the Cumberland Plant. (Commentor: Center for Biological Diversity)

Response: In conducting an alternatives analysis, agencies must "[e]valuate reasonable alternatives to the proposed action, and for alternatives that the agency eliminated from detailed study, briefly discuss the reasons for their elimination." 40 CFR § 1502.14(a). An agency must consider a reasonable number of alternatives, which are bounded by the purpose and need for the proposed agency action. Id. at § 1502.14(f), § 1502.13; *see also Coal. for the Advancement of Reg'l Transp. v. Fed. Highway Admin.*, 576 F. App'x 477, 481 (6th Cir. 2014); *Citizens Against Burlington, Inc. v. Busey,* 938 F.2d 190, 195 (D.C. Cir. 1991) ("[A]n alternative is reasonable only if it will bring about the ends of the federal action.").

The purpose of the proposed action is to retire and decommission the first CUF coal unit by 2026 and the second unit by 2028, and to implement replacement generation that can supply 1,450 MW of firm, dispatchable power by the time the first unit is retired in 2026. The need for the Proposed Action is to ensure that TVA is able to meet required year-round generation and maximum capacity system demands and planning reserve margin targets, particularly during peak load events.

This proposed action is one piece of TVA's overall asset strategy, which blends a combination of resource technologies to allow TVA to support affordable, reliable, and cleaner energy for its customers. TVA's asset strategy already contemplates the blending of resources to provide the least-cost, optimal portfolio under a variety of future conditions, including the addition of 10,000 MW of solar by 2035. A key beneficial result of TVA's asset strategy is the reduction of carbon emissions. See EIS Section 1.1. As discussed in detail in EIS Section 1.1, this action is a specific, discrete component of that asset strategy and is consistent with the need established by the 2019 IRP to establish new capacity in the TVA region, increase reliability and flexibility, increase energy efficiency, and meet TVA energy production goals.

In addition to the No Action Alternative, TVA considered three action alternatives in the Draft EIS: Alternative A- the retirement of CUF and construction and operation of a combined cycle (CC) gas plant at the same site; Alternative B- the retirement of CUF and construction and operation of simple cycle combustion turbine (CT) gas plants at alternate locations; Alternative C- the retirement of CUF and construction and operation of solar and storage facilities, primarily at alternate locations. All natural, cultural and socioeconomic impacts associated with each alternative are analyzed in Chapter 3 of the EIS.

Further, Section 2.1.6 has been revised to further detail alternatives that were "considered but not carried forward" for more detailed analysis because they do not meet the project purpose and need. In particular, in EIS Section 2.1.6, TVA evaluated a number of other resource options for replacement generation, including: natural gas-fired CC, natural gas-fired CT, battery energy storage systems (BESS), utility-scale photovoltaic (PV) solar, hydro pumped storage, small modular reactors, wind, energy efficiency, demand response, and distributed generation.

TVA also evaluated other blended alternatives, including one that combines a lower amount of natural gas with other technologies, such as solar and battery storage. See EIS Section 2.1.6.1.

After careful consideration, TVA determined that blended alternatives would not meet the project's purpose and need and therefore the EIS does not evaluate in more detail blended alternatives other than Alternative C.

2. The EPA recommends the EIS include additional justification for why, in the context of the IRP, TVA has chosen the Cumberland site for the addition of combined cycle units. Given that the Cumberland site requires the construction of a 32-mile natural gas pipeline, it is unclear why an alternate site, such as Johnsonville, which has or will have natural gas capability would not meet TVA's purpose and need while significantly reducing environmental impact and expenditures associated with construction of a new pipeline. (Commentor: US Environmental Protection Agency)

***Response*:** The IRP is a long-term strategic plan that provides direction on how TVA can best meet future demand for power. It does not prescribe specific asset retirement or build decisions, leaving these decisions for further environmental study and review. The purpose and need of the proposed action, including the retirement of CUF coal units and construction of replacement generation, is based on the results and recommendations of the IRP, which call for TVA to review engineering end-of-life dates for aging fossil units and recommend up to approximately 6,000 MW of combined cycle additions by 2028.

See Section 2.1.3.2.1 of the Final EIS (Site Evaluation for New CC Plant) for an explanation of the benefits of locating the CC plant on the CUF Reservation and factors TVA used to select it as the site for the CC plant. Among other reasons, locating the CC plant on the Cumberland reservation takes advantage of existing transmission interconnection to the TVA system and would allow for the pipeline to be sited along an existing TVA transmission line corridor, reducing potential environmental effects. Upon consideration of all siting criteria (including, but not limited to, transmission availability, required transmission upgrades-both directly associated with the CC and regional upgrades required for grid stability, air permitting prospects, staffing, fuel supply, etc.) TVA determined that the Cumberland Reservation was the preferred location.

Further, the proposed CC plant at CUF could be built and made operational sooner than other alternatives, which reduces economic, reliability and environmental risks, thereby meeting the stated purpose and need.

3. TVA should disclose whether a diversified alternative of renewable energy resources that reduces capacity needs and transmission congestion could also reduce the need for a new pipeline. (Commentor: US Environmental Protection Agency)

Response: In EIS Section 2.1.6, TVA evaluates other potential renewable energy resources and other potential blended alternatives, many of which would not require a new natural gas pipeline. TVA concludes that these alternatives would not meet the project's purpose and need to retire and decommission the first CUF coal unit by 2026 and the second unit by 2028, and to implement replacement generation that can supply 1,450 MW of firm, dispatchable power by the time the first unit is retired in 2026.

See also response to *Comment No. 1* and Chapters 1 and 2 of Final EIS.

4. A critical aspect of any EIS is properly defining the purpose and need for the project. That purpose is vital to determining which alternatives must be evaluated. E.g. League of Wilderness Defs.—Blue Mts. Biodiversity Project v. United States Forest Serv., 689 F.3d 1060 (9th Cir. 2012). Here, because TVA has improperly defined the purpose of closing

the Cumberland Plant, the agency has declined to meaningfully consider appropriate alternatives and their relative impacts on the environment.

TVA is not closing the Cumberland Plant simply because the Plant is old, but because continuing to burn coal is devastating to the environment and the climate.

The Draft EIS defines the need to close the Cumberland Plant as simply the result of its age and reliability challenges. TVA then narrowly defines the purpose of the EIS to be evaluating alternatives to continue providing cost-effective power generation, without any reference to any environmental objectives. This violates NEPA, which requires that an agency "specify the underlying purpose and need for the proposed action," 40 C.F.R. § 1502.13, and prohibits an agency from defining "its objectives in unreasonably narrow terms." Nat'l Parks & Conservation Ass'n v. BLM, 586 F.3d 735, 746 (9th Cir. 2009); City of Carmel-By-The-Sea v. United States Dep't. of Transp., 123 F.3d 1142, 1155 (9th Cir. 1997). By limiting the purpose in this manner, TVA has avoided meaningfully considering alternatives that would hasten TVA's transition to non-polluting energy sources, including an alternative that prioritizes replacing Cumberland's power generation with DERs, energy efficiency, and other non-wires alternatives. The fact that the EIS obliquely refers to a transition to cleaner technologies occurring in TVA territory does not ameliorate this concern. As framed in the EIS, this is something that TVA is simply considering, not a purpose of the actual project under review or a need TVA is working to fulfill. In short, TVA must reframe the purpose and need for the EIS as evaluating alternative ways to replace the Cumberland Plant's generation with fossil-free approaches that do not exacerbate the climate emergency, consistent with the TVA Act, President Biden's Executive Orders, and the desperate need for a rapid transition away from fossil fuels. Indeed, the alternatives that TVA does include in the EIS belies TVA's claim that cheaply replacing the Cumberland Plant is the agency's only concern. TVA does not even consider the possibility of simply updating the Cumberland Plant, or otherwise continuing to provide the Plant's generation through a new coal-burning facility, because implicit in TVA's purpose and need is a recognition that coal is simply too polluting and devastating for the climate to be considered. Accordingly, because it is evident that environmental objectives are part of the purpose and need for this project, TVA must explicitly acknowledge the goal of replacing the Cumberland Plant with the least polluting alternative, thereby opening the door to a meaningful set of alternatives. (Commentor: Center for Biological Diversity)

Response: TVA has not stated its objectives in unreasonably narrow terms. The purpose and need for the proposed action to retire CUF and replace part of the retired generation is based on implementing the target supply mix of the 2019 IRP and the Aging Coal Fleet End-of-Life Evaluation. See response to *Comment No. 1* regarding development of the purpose and need.

See Response to *Comment No. 42* for a discussion of TVA's overall asset strategy, which accounts for demand response, energy efficiency, and development of renewables.

TVA's Preferred Alternative would allow for the retirement of the coal-fired units at CUF, but the commenter incorrectly suggests that the EIS does not evaluate continued use of the CUF coal-fired units. As the Final EIS Section 2.1.2 explains, without the proposed action, under the No Action Alternative, TVA would need to continue operating the CUF coal-fired units. See response to *Comment No. 32*.

See the updated Purpose and Need section in the Final EIS and TVA's Aging Coal Fleet Evaluation at https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/aging-coal-fleet-evaluation2eeb5bd7-1983-4d03-ac5b-c105e2686d07.pdf?sfvrsn=3425c191_3.

NEPA REVIEW FOR PIPELINE PROJECT UNDER ALTERNATIVE A

5. The EPA notes that the proposed natural gas pipeline is related to the proposed action alternative and associated impacts should be analyzed as a whole. (Commentor: US Environmental Protection Agency)

Response: The Final EIS includes a detailed evaluation of the combined impacts of the proposed CC Plant and natural gas pipeline lateral under Alternative A. See response to *Comment No. 9.*

6. Preparations for the gas pipeline are premature, given that the NEPA process is not complete. TVA should give the same treatment to the solar plus storage options as it has already been done with gas. (Commentor: US Environmental Protection Agency)

Response: The gas pipeline is integral to TVA's proposed action of construction and operation of the CC plant and therefore the effects of the pipeline are considered in detail in this EIS. In addition, because the pipeline proposed by Tennessee Gas Pipeline (TGP) requires authorization from FERC, it is the subject of a separate EIS being prepared by FERC. TGP's construction of the natural gas pipeline will not begin until FERC's NEPA review is complete and it issues an authorization.

TVA has given Alternative C the same treatment as other alternatives. TVA used the best information available to evaluate and consider the potential impacts from Alternative C. Since information relating to the identification of the large number of sites (20+) and the associated transmission infrastructure for Alternative C was not available at this stage, TVA assessed the impact of the alternative through alternative means. See Sections 3.2 and 3.3 for further information.

See also the response to *Comments No.8, 9, and 10*.

7.* For the following reasons, TVA should not move forward with any of the three options at this time*:

- **There have been dramatic and consequential changes in global energy markets subsequent to the preparation of the 2019 IRP that are relevant in the consideration of a Cumberland replacement that do not appear to have been considered DEIS. Drivers of global energy market changes include:**
    - **War in Ukraine**

    - **Covid Pandemic**
    - **Global Supply Chain Issues**
    - **Results of the 2022/2023 MISO Planning Resource Auction (PRA) - There was almost a 50-fold increase in capacity prices in MISO Zones 1-7 as a result of the expected capacity shortage due to the mismatch between retirements of dispatchable resources and additions of intermittent resources. Further, MISO advised that load shedding could occur as a result of the resource deficiency.**
- **Permitting of new natural gas pipelines including laterals could affect the timing and cost of the Cumberland replacement.**
    - **Natural gas pipelines are facing increasing challenges in permitting.**
    - **The DEIS confirms the lateral will need FERC approval but does not acknowledge that approval is not guaranteed. The DEIS indicates that it has already entered into a precedent agreement with Texas Gas Pipeline related to the lateral but does not disclose costs or the terms of the agreements or how the pricing compares to what was assumed in the IRP.**
    - **Economic conversion of a combined cycle plant to hydrogen cannot be assumed and the 2019 IRP does not mention hydrogen. Thus there is simply no basis for TVA to assume a partial or complete hydrogen conversion is feasible or economic.**
- **The DEIS misrepresents the technical and economic issues associated with a conversion of the preferred CC option to hydrogen and ignores the potential requirement to add carbon capture (CC) to any new CC plant during the CC plant's economic life. By doing so, DEIS does not disclose the full impacts of TVA's proposal on its customers related to the stranded Cumberland plant costs, the costs associated with a possible requirement to either convert a new CC plant to hydrogen or retrofit it with carbon capture.**
    - **TVA does not address the potential need to retrofit combined cycle plants with carbon capture other than to state, "combustion turbine units hold promise in further contributing to a net-zero future through the use of alternative fuels, such as hydrogen, and/or carbon capture and sequestration (CCS) technology." This is an effective acknowledgement of the fact that a CC plant absent carbon capture (or hydrogen conversion) is not consistent with a net-zero future.**
    - **Given this acknowledgement, the analysis supporting a new CC assuming a 30 to 40 year life without consideration of the cost to keep the plant in operation in a net zero world is without merit. At a minimum, TVA should reconsider the economics assuming either a 15-year life or a carbon capture retrofit in 15 years.**
- **The options considered in the DEIS do not include the possible viable option of small modular nuclear reactors (SMR) despite TVA's acknowledgement in the IRP as to their potential viability. Nor does TVA acknowledge its own interest in SMR's including its initiatives with SMR's at the Clinch River site.**

- **SMRs are not mentioned or considered in the DEIS as a replacement for Cumberland. At a minimum, the SMR option should have been considered in concert with continued operation of Cumberland. In other words, rather than focusing on an accelerated retirement of Cumberland, the real question is whether with a slightly delayed retirement of Cumberland is in order to allow for SMRs to be the replacement is the best outcome. (Commentors: State Coal Associations – Illinois, Kentucky, West Virginia*)***

Response: FERC certification under the Natural Gas Act is required for the pipeline, and FERC is preparing an EIS on the pipeline to inform its decision. In addition, TVA is treating the pipeline as a related action for purposes of its review of Alternative A. Chapter 3 of the Final EIS has been revised to describe in detail the potential impacts from constructing and operating the pipeline.

TVA is party to a precedent agreement with Tennessee Gas Pipeline (TGP), an affiliate of Kinder Morgan, whereby TGP will develop and construct the pipeline should Alternative A be selected by TVA and FERC approve the pipeline. Kinder Morgan is one of the largest energy infrastructure companies in North America, with an extensive track record of securing permits and FERC approvals for pipeline projects.

In EIS Section 2.1.7, TVA considered other resources, including small modular reactors, and alternative fuels and carbon capture sequestration, but determined that they would not meet the project's purpose and need. In EIS Section 2.3.2, TVA evaluated CCS and the combustion of hydrogen as potential future mitigation for Alternative A. See also updated Purpose and Need section of the Final EIS and Aging Coal Fleet Evaluation at https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/aging-coal-fleet-evaluation2eeb5bd7-1983-4d03-ac5b-c105e2686d07.pdf?sfvrsn=3425c191_3. See the response to *Comment No. 58* (2019 IRP Scenario Analysis), *Comment No. 42* (TVA's Asset Strategy, Alternatives Considered but Dismissed, including SMRs), and *Comment No. 33* (Air Quality/GHG/SCC).

8. TVA appears to have predetermined the outcome of the NEPA process by signing binding agreements for the methane gas Alternative A would use. Since TVA signed a precedent agreement to purchase gas supply from Tennessee Gas Pipeline prior to issuing its DEIS preference for Alternative A, TVA should discuss how it maintains objectivity in the comparison of alternatives. (Commentors: US Environmental Protection Agency, Southern Environmental Law Center)

Response: TVA executed a precedent agreement with Tennessee Gas Pipeline on August 11, 2021. The precedent agreement is a preliminary agreement to enter into a future firm gas transportation agreement if certain conditions precedent are met. These conditions include completion of TVA's environmental review for the Cumberland Fossil Plant and an affirmative decision by TVA to select Alternative A and develop a new CC plant at the Cumberland site. TVA's objectivity is not impacted by the precedent agreement because it does not constitute an irreversible or irretrievable commitment by TVA to enter into a gas transportation agreement with (or to purchase gas supply from) Tennessee Gas Pipeline. The agreement helps preserve

the viability of Alternative A without irreversibly committing TVA into entering into a firm gas transportation agreement.

The precedent agreement does not prevent TVA from pursuing another alternative. For example, TVA has also worked with pipeline operators to explore natural gas transportation options for the Alternative B CT plants. The existing Johnsonville Combustion Turbine Plant is currently supplied by Tennessee Gas Pipeline, and the existing Gleason Combustion Turbine Plant is currently supplied by ANR Pipeline, an affiliate of TC Energy. Neither of these locations would require significant new pipeline infrastructure to support the proposed CT plants, and therefore would not necessitate a precedent agreement to maintain the option for the time frame required for new generation.

9. The EPA recommends discussing why the closely related, interdependent natural gas pipeline whose need is triggered by Alternative A is undergoing a separate and distinct NEPA review, rather than a joint NEPA document with Federal Energy Regulatory Commission (FERC) as provided by 40 CFR § 1501.9(e). (Commentor: US Environmental Protection Agency)

Response: At the time of scoping the EIS, TVA determined, in consultation with FERC, the agencies would prepare two separate independent reviews for the different agency actions. The considerations that went into this determination included: (1) Project schedules for the two federal actions, TVA's action to replace generation at CUF and FERC's action to issue a certificate for the pipeline, did not align timewise, as it would not make sense for FERC to complete its review of the pipeline prior to TVA's decision regarding replacement generation (the basis of FERC's Purpose and Need); and (2) TVA's status as the "shipper[1]" for the pipeline project which could be perceived as a conflict of interest. For these reasons, FERC is preparing its own EIS for the pipeline, which can incorporate and rely on aspects of the CUF EIS, as appropriate.

Notwithstanding the fact that FERC is preparing its own EIS for the pipeline, TVA has considered the impact of the replacement generation and the pipeline (for Alternative A) in detail in this EIS, consistent with 40 CFR Section 1501.9(e). This EIS appropriately uses the information that is currently available to fully consider the environmental impacts of the plant and the pipeline. See Kentucky Coal Ass'n., Inc. v. T.V.A., 804 F.3d 799, 806 (6th Cir. 2015). TVA included an analysis of the related proposed pipeline associated with Alternative A in the Draft EIS. The DEIS incorporated the results of a GIS-based environmental analysis of a 200-foot-wide corridor for the proposed pipeline lateral and temporary access or construction areas. While pipeline easements are typically 50 feet wide and the associated construction corridor 100-feet wide, TVA used a wider 200-foot corridor to provide a more robust estimate of potential impacts. Since the publication of the Draft EIS, TGP has conducted extensive field-based surveys and assessments of the various environmental resources potentially affected by the

[1] An entity ((person, company, or agency) that purchases services with respect to the transmission of natural gas by way of a natural gas transmission pipeline from the owner or operator of the pipeline, whether or not the gas is transported for the entity's own use.

pipeline. The Final EIS has been updated to incorporate this more detailed information which is drawn from TGP Draft Resource Reports submitted to FERC.

10. Deferring analysis of the environmental impacts from methane gas pipeline construction and operation has resulted in a DEIS that is premature, incomplete, and inadequate. (Commentor: Southern Environmental Law Center)

Response: See response to *Comment No. 9*. The EIS considers in detail the effects of the proposed pipeline. In particular Section 3.7 of the Final EIS has been updated with information provided in TGP's FERC Resource Reports and the results of a life cycle analysis of the Project alternatives.

INFLATION REDUCTION ACT OF 2022

11a. TVA should analyze how federal legislation that puts a price on carbon, that increases over time, influences the analysis. The Inflation Reduction Act materially changes the circumstances under which TVA will make the decisions it considers in the DEIS. Provisions in the IRA significantly alter the economic framework within which TVA is deciding whether to build a new gas-burning facility. Portions of the Act described below, among others in the IRA, have created a "seriously different picture of the environmental landscape" that requires additional analysis under NEPA.

The IRA includes provisions that appear to directly affect TVA's cost calculations for its options to replace the Cumberland Fossil Plant. Those include extending the production tax credit for renewable power facilities and providing bonus credit for renewable power projects in "energy communities" where a coal-fired electric power plant was or will be retired in 2010 or later. The IRA also extends a similar investment tax credit for renewable power generation and energy storage projects, with additional credit for siting those projects in an energy community, and offers a new tax credit for several years for new non-GHG emitting electricity generation projects. In addition, the Act expressly allows TVA to directly monetize tax credits for newly constructed solar and other renewable energy projects as a tax payment and, in some cases, for those credits to be payable as a cash refund from the IRS.

The IRA also includes provisions that appear likely to increase the cost of building unmitigated gas-burning power plants. The Act will require carbon capture equipment on some electric generating units, but also enhances tax credits for carbon capture and sequestration by, among other improvements, adding direct pay for installing carbon capture equipment, increasing credit values for storing capture carbon dioxide, lowering the capture threshold at which a facility is eligible for tax credit. Further, the "Methane Emissions Reduction Program" described in the Act will create a maximum methane waste emission rate, beyond which a facility that emits additional methane will be subject to an escalating scale of penalties.

Alongside increasing the cost of gas-powered generation facilities, the Act aims to lower the cost of the kinds of renewable assets that TVA considers in Alternative C. The IRA

creates a new tax credit for domestic manufacturing of solar and wind related components, batteries, and critical minerals. And the Act creates a new tax credit for solar or wind projects located in low-income communities. Finally, the IRA may significantly alter TVA's load growth forecasts, as well as the load curve that TVA can expect throughout the lifetime of the new generation assets it builds. The Act expands access to new and used electric vehicles, and incentivizes energy efficiency for homes and commercial buildings. (Commentors: Southern Environmental Law Center, US Environmental Protection Agency, Citizens Climate Lobby)

Response: While the recently enacted Inflation Reduction Act (IRA; Public Law No: 117-169) may improve pricing and availability for renewable resources in the long term, the actual effect of that legislation on solar markets is presently unknown. TVA is optimistic that the legislation will enable faster adoption of renewable resources on TVA's system in the long term, but asserts that the legislation would not affect the transmission-related time constraints described in the Final EIS for Alternative C that impair the ability of this alternative to fully meet TVA's purpose and need of firm, dispatchable generation by the end of 2026. Thus, the IRA does not alter TVA's selection of the preferred alternative (Alternative A) nor does it change the least-cost planning analysis that led to TVA's adoption of the target supply mix in the 2019 IRP.

At the request of TVA, Concentric Energy Advisors performed an assessment of the Draft EIS, reviewed certain reports provided during public comment period, and provided observations on the potential importance of the 2022 IRA. Concentric concluded: "While the IRA impacts must be more fully modeled and explored, fundamental concepts and conclusions remain unchanged, such as the escalating complexity of adding renewable resources, the need for broad and rigorous analyses, and ultimately the need for dispatchable generation as part of a diverse and reliable generation portfolio. From a near-term perspective, the practicality of Alternative A over Alternative C is unchanged. While the IRA would improve the economics for Alternative C, the cost improvements would not eliminate its implementation barriers." See Appendix Q of the Final EIS for the Concentric Report.

11b. The IRA includes provisions that would increase the cost of building natural gas power plants by establishing a maximum methane waste emission rate, beyond which a facility that emits additional methane will be subject to penalties. (Commentor: Southern Environmental Law Center)

Response: The IRA imposed a fee on methane emissions that exceed a specific threshold [42 U.S.C. 7436], thereby potentially increasing the cost of natural gas-fired generation relative to other options. This fee, set at $900/metric ton in 2024, $1,200/metric ton in 2025, and $1,500/metric ton in 2026 and thereafter, will apply to "applicable facilities" – in general, oil and gas production, processing, and transportation facilities. The fee does not apply to natural gas-fired electric generating units. However, the fee could increase the cost of electricity production at gas-fired EGUs if it results in an increase in delivered natural gas costs. A 2021 analysis by Resources for the Future found that based on the central estimate impact of a full supply chain fee, the increase to the wholesale price of natural gas would range from $0.15-0.22/MMBtu. See https://www.rff.org/publications/issue-briefs/methane-fees-effects-on-natural-gas-prices-and-methane-leakage/. This assumed a $3/MMBtu price of natural gas, but the authors noted that the estimates were not sensitive to the natural gas price. We note that the impact of a relatively small incremental cost of $0.15-0.22/MMBtu would not have a material impact on the

preferred alternative (Alternative A) being the least-cost choice. Moreover, the IRA also included $1.55 billion in funding for grants, loans, and other financial assistance to reduce methane emissions, which could reduce the impact to delivered gas prices by an amount that is not possible to be estimated at this time.

ALTERNATIVES AND ENERGY RESOURCES

12. The DEIS claims that any replacement of Cumberland must be capable of meeting peak capacity year-round. Recent trends suggest that the current energy generated is similar to the solar generation in the region (twice as much in the summer months as in winter). TVA has stated that it intends to build 10,000 MW of solar-powered energy and should do so now. Has TVA considered a staged approach in providing backup power for solar power? (Commentors: Citizens Climate Lobby, Clean Up TVA Coalition)

Response: This EIS tiers from the 2019 IRP, and explains the various scenarios and strategies TVA considered in the development of the recommended target power supply mix. A diverse generation portfolio like the target supply mix TVA has identified offers reliability and resiliency across the system.

TVA is planning to expand its solar capacity by adding 10,000 MW by 2035, complemented with battery storage, in order to meet customer and system demand. In order to provide dependable peak capacity needs for the TVA system, solar generation must be paired with dispatchable resources, such as storage or gas, as in Alternatives A and C. The first Cumberland unit cannot be retired until firm, dispatchable replacement generation is operational. Natural gas-fired units, including the addition of a CC at Cumberland, enable the retirements of older coal-fired units with higher carbon intensity, enable greater levels of renewables on the system, and provide reliability support as TVA integrates large quantities of intermittent renewable generation into the system. (Appendix Q, p. 19)

The Cumberland plant is currently a baseload generating facility that is capable of running at any time and the proposed action represents the most-cost effective replacement generation alternative. Given the type of power generation supported by the Cumberland plant, solar generation and battery storage alone, will not provide the firm, dispatchable generation needed to meet required year-round generation. See EIS Section 1.1.

See response to *Comment No. 54* and the Purpose and Need section in the Final EIS.

13. Looking at a number of trends (migration to the southeast, a warming climate, restoring of manufacturing and the electrification of transportation and heating) all speak to rapid growth in electrical demand in the Tennessee Valley. Has TVA taken a hard look at what electric power demands will be in 5-10 years, and how much grid capacity margin does the proposed replacement plan yield by year over the next 20 years?

Some authors have pointed out that the EIA's natural gas reserve estimates are grossly optimistic, with most of the most promising sites in the Marcellus formation having already been tapped. If this is true, then natural gas prices will be even more volatile, exposing TVA's rate payers to some significant risk. What are the foreword looking

estimates for natural gas prices & power over the next 20 years, and how is TVA mitigating this risk?

Building a natural gas fired plant seems to be a short term solution that will expose rate payers to increased volatility in prices plus energy shortfalls. A more obvious solution would be to replace the Cumberland river coal site with a nuclear station, either conventional or a SMR. Please provide the rational explanation for TVA not going down this path? (Commentor: Stephen Black).

Response: TVA updates the IRP approximately every 4 to 5 years. The most recent 2019 IRP is a long-term plan that provides direction on how TVA can best meet future demand for power. It shapes how TVA will provide low-cost, reliable, and clean electricity; support environmental stewardship; and foster economic development in the Tennessee Valley for the next 20 years. The IRP helps enhance TVA's ability to create a more flexible power-generation system that can successfully integrate increasing amounts of renewable energy sources and distributed energy resources while ensuring reliability. All proposed Action Alternatives are within the ranges of asset additions recommended by that IRP.

A range of load and gas price forecasts were used in the development of the 2019 IRP, and TVA expects to remain within the bounds of those ranges (see Section 6.1.3 of the 2019 IRP for a discussion on scenario development, including Valley Load Growth and Economic Downturn scenarios; see Section 8.2.1 of the 2019 IRP for the range of natural gas prices evaluated). TVA also reduces gas price uncertainty through a combination of physical and financial hedging.

The proposed Cumberland project is one piece of TVA's overall asset strategy, which blends a combination of resource technologies to allow TVA to support affordable, reliable, and cleaner energy for its customers. As discussed in Section 2.1.7 (Alternatives Considered but Eliminated from Further Discussion) of the Final EIS, TVA did look at Small Modular Reactors as a potential alternative; however, the longer construction timeline and first-of-kind deployment risks associated with this technology fail to meet the 2026 timeline for the first unit retirement at CUF.

14: TVA's entire project is based on a false premise: that TVA must replace its Cumberland Plant with another form of centralized power generation to meet consumer demand. In TVA service territory, residential demand has remained stagnant in the last decade, and there remains great interest in developing distributed energy and other non-centralized energy approaches. Accordingly, TVA cannot proceed on the false assumption that the generation lost from closing the Cumberland Plant needs to be replaced with another form of centralized generation. Rather, TVA needs to consider the extent to which—either because of affirmative TVA actions, changes in demands and markets, or some combination of both—demand for centralized TVA power may decline in coming years, making replacement of this generation unnecessary, in whole or in part.

Under the current preferred alternative, TVA will continue to be one of the largest emitters that are fueling climate change, and thus will continue to be responsible for the devastating impacts that are certain to come in the country and around the world as we

continue to increase the concentrations of GHGs in the atmosphere. Alternatively, under a renewable energy alternative that maximizes DER, storage, and energy efficiency, as well as an expedited retirement timeline, TVA would not only commit its requisite part in phasing out fossil fuels and lowering GHG emissions, but also in addressing environmental justice concerns associated with a reliance on false solutions like fossil gas. (Commentors: Center for Biological Diversity, Southern Environmental Law Center)

***Response*:** The comment inaccurately characterizes TVA's contribution to a global phenomenon. In addressing this comment, proper context requires acknowledging that atmospheric levels of CO_2 have increased on a global scale by approximately 12.5 ppm from 1900 to 2020 (Congress created TVA in 1933; see Section 3.7.1.1.8). The 2019 global CO_2 emission estimates for energy consumption were 33,500 MMT(see Section 3.7.2.3.1). In 2019, total CO_2 emissions for the entire U.S. were approximately 5,144 MMT, with electricity accounting for approximately 25% of this total (29% transportation, 23% industrial, and 23% agriculture) or approximately 1,286 MMT (see Section 3.7.1.1.8). TVA's system wide CO_2 emissions in 2019 are estimated to be approximately 43.1 MMT (representing a 58% decrease between 1995 and 2019), while CUF's CO_2 emissions in 2019 are estimated to be approximately 9.1 MMT. This results in CUF's contribution to U.S. energy sector and global CO_2 emissions in 2019 as 0.7 percent and 0.03 percent respectively. Under the No Action Alternative, CUF's annual CO_2 emissions would be approximately the same as in 2019. Under Alternative A, the CUF CO_2 annual emissions would be approximately 2.5 MMT or a reduction of approximately 75 percent. Alternative B would result in no operational CO_2 emissions at CUF but an annual increase of approximately 0.75 MMT of CO_2 at the Johnsonville and Gleason plants. Alternative C would also result in no operational CO_2 emissions at CUF. Under Alternative A, the Cumberland CC plant's contribution to U.S. energy sector and global CO_2 emissions (based on 2019 comparison) would be approximately 0.2 percent and 0.01 percent, respectively.

TVA continuously monitors a variety of market signals to inform its planning, including forecasts for loads, commodities, and resource costs. Higher demand expectations for residential and supporting services, such as data centers, is being driven by an observed shift in interstate migration patterns into the Valley that is expected to continue. Incorporating these trends, TVA's current load forecasts indicate slightly increasing peak loads over the next 20 years. With the approved retirement of Bull Run Fossil Plant in 2023, TVA will be at minimum reserve targets and must therefore replace any retiring capacity with dependable capacity to maintain summer and winter targets.

As specified in Section 2.1.6 of the Final EIS, Energy Efficiency, Demand Response and Distributed Energy Resources (DER) were considered but not carried forward for more detailed evaluation due to their inability to meet the purpose and need of this project. See *Comments No. 5, 19*, and *40* for further discussion of alternatives considered, and *Comments No. 70, 71*, and *78* for further discussion on environmental justice concerns associated with GHGs.

15. TVA does not need additional gas to integrate solar. For a point of comparison, Duke's two utilities that operate in the Carolinas, Duke Energy Progress (DEC) and Duke Energy Carolinas (DEP), have a combined system capacity approximate to TVA's. DEC

and DEP already have over 3 GW of solar operating on the two systems with significantly less gas and hydro than TVA, and a similar capacity from nuclear. And TVA's three gas combustion turbine projects that will be online in the next two years will only increase TVA's ability to integrate solar without adding new gas. TVA makes false claims that a new CC will be needed to integrate solar into TVA's system but does not provide any evidence to back up that claim. Based on what other utilities are doing across the world, and even TVA's neighbors, that claim just does not make sense.

TVA's DEIS states that the 3 GW of solar added in Alternative C is in addition to the 10 GW TVA claims it will have on its system by 2035. From statements made by TVA leadership, the main driver of those 10 GW of solar is for large customers (corporate/industrial/commercial) with clean energy goals, or cities with clean energy or carbon goals. That 10 GW of solar by 2035 goal has in interim target of 5 GW of solar by 2030, of which 2.4 GW is operating or contracted for and scheduled to come online in the coming years. Assuming that 2.4 GW comes online by the end of 2023, that leaves 2.6 GW remaining of the 2030 goal, and spread evenly that's the addition of just 372 MW of solar each year. As such, if TVA does not replace any of Cumberland with solar, it would be at approximately 3,516 MW of solar by the end of 2026. If TVA were to add an additional 3 GW of solar, as laid out in Alternative C, the system would have a total of approximately 6,516 MW of solar by the end of 2026. Based on the capacity projections from TVA's 2019 Integrated Resource Plan (IRP), which are the latest that have been made public, these levels of solar would mean solar would be approximately 8% of TVA's total nameplate capacity by the end of 2026 under Alternative A and solar would be approximately 14% of TVA's total nameplate capacity by the end of 2026 under Alternative C. By comparison, Duke's combined utilities in the Carolinas had 9% of total nameplate capacity as solar in 2020 and are expected to increase solar to 15% of nameplate capacity by the end of 2026 and 19 percent of nameplate capacity by the end of 2030 under the utilities' current resource plans.

Using the values from TVA's 2019 IRP for capacity credit and peak load forecasts from the 2020 FERC 714 report (published June 21, 2021), because the winter capacity credit that TVA assumes is zero, the winter reserve margin for Alternative C is only one percentage point lower than the winter reserve margin for Alternative A. In addition, the summer reserve margin is 8 percentage points higher under Alternative A than under Alternative C. While TVA has not added more than 1,000 MW of solar in a single year, the integration of that level of solar in a single year is physically possible and the levers that make it possible, such as the contracting and interconnection process, are within TVA's control.

In addition to reducing the amount of solar and storage needed to replace one unit of the Cumberland coal plant, TVA should include more diversity in the sources it included in its analysis. For instance, the financial incentives TVA would need to provide in energy efficiency, demand response, and rooftop solar would provide similar energy and capacity benefits at a fraction of the cost because the participating customers would

bear most of the resource costs. In fact, since TVA has a higher winter planning reserve margin in its 2019 IRP, if TVA focused financial incentives on energy efficiency and demand response programs with load shapes that are known to shave the winter peak, it would both improve reliability and resilience over the construction of a gas CC, and fill the reserve margin and energy needs of its customers at a lower cost. TVA must not finalize the Cumberland replacement EIS without analyzing the potential to use winter peak-focused demand-side measures to replace some of the energy and reserve margin that Cumberland currently provides (Commentor: Southern Alliance for Clean Energy).

Response: The comparison to the Duke system made by the commenter is inapt because system demand, weather patterns, fleet composition, import capability, and other factors, vary by utility and region. See Response to Comment 14 regarding demand levels.

This proposed action is one piece of TVA's overall asset strategy, which blends a combination of resource technologies to allow TVA to support affordable, reliable, and cleaner energy for its customers. TVA's asset strategy already contemplates the blending of resources to provide the least-cost, optimal portfolio under a variety of future conditions, including the addition of new solar generation elsewhere on the TVA system. The purpose of the proposed action, which implements one piece of TVA's overall asset strategy, is to retire and decommission the first CUF coal unit by 2026 and the second unit by 2028, and to implement replacement generation that can supply 1,450 MW of firm, dispatchable power by the time the first unit is retired in 2026. See response to Comment No.1 for further clarification on the purpose and need, which explains why the proposal in this comment is not in alignment with TVA's needs at this time.

The Intermittent Resources Study and Flexibility Study in Appendix D of the 2019 IRP identify sub-hourly flexibility benefits of adding firm, dispatchable power to integrate solar at various penetration levels. The EIS evaluates in detail Alternative C, which includes 1,700 MW of battery storage in order to provide firm, dispatchable capacity to complement the replacement, intermittent solar energy, and to meet TVA's target winter reserve margin. As detailed in the Concentric Report (Appendix Q), while battery storage is making technological advancements, industry understanding and modeling of how large amounts of battery storage will impact the grid is based on limited experience. Adding 1,700 MW of battery storage under Alternative C by 2026 would result in TVA adding, owning, and operating more battery storage capacity over the next 4 years than the entire United States had in 2020. See Concentric Report discussion of Alternative C at 23-24. Ultimately, even assuming Alternative C could provide the needed capacity, the EIS concludes that Alternative C is not the Preferred Alternative due to various reasons including its higher cost and the fact that it would require extensive transmission upgrades that cannot be completed by the time replacement generation is needed in 2026.

TVA has experienced escalations in cost of domestic US PV Solar development due to global supply chain constraints caused by the global pandemic (about 40% from FY2021 to FY2022) which has challenged TVA's ability to integrate large amounts of solar in recent years. However, as outlined in TVA's May 2021 Strategic Intent and Guiding Principles document, TVA expects to add 10,000 MW of solar by 2035. Additionally, TVA is supporting our many long-term local power company partners in the deployment of up to 2,000 MW of distributed solar.

16. **TVA should increase the renewable component of their energy fleet mix to the maximum extent feasible and to fully consider Alternative C in their decision-making process (Commentor: US Department of Interior-National Park Service).**

Response: See response to *Comments. No. 53* and 58 regarding target supply mix and IRP Scenario Development. The commenter's preference for Alternative C has been noted. Alternative C has been evaluated to the extent feasible at this time and, should TVA select this alternative, additional environmental reviews tiered from this EIS will be conducted for its associated solar and storage facilities.

17. It would be helpful if TVA could better address the feasibility of implementing Alternative C in the EIS by addressing the following questions (Commentor: US Department of Interior-National Park Service):

a. **What is the time frame for feasibly implementing this alternative? Does TVA expect it will be feasible in the next five years?**

Response: The expected duration for the transmission work alone associated with Alternative C is 9-11 years for the reasons explained in Section 2.1.6.

b. **If TVA selected Alternative C, how would it impact the scheduled retirement of the CUF coal-fired units (if at all)?**

Response: Because implementation of Alternative C would take a minimum of 9 years to complete, the first unit at CUF could not be retired by 2026. As described in Section 1.1.2 of the Final EIS, in order to meet the purpose and need of the project, 1,450 MW of replacement generation is needed to replace the first retiring unit at Cumberland and must be operational before the first Cumberland unit is retired in 2026. If this replacement generation is not in place it would leave TVA short on required generation and capacity to meet system demands and planning reserve margin targets . Delay in implementation of the 1,450 MW of replacement generation likely would lead to the continued operation of the Cumberland coal unit for some period of time. If the first Cumberland unit must stay in operation beyond 2026, significant investment would be required to maintain safe and reliable operations and comply with environmental regulations. Operation beyond 2026 would also inject operational risk back into the TVA system due to the deteriorating condition of the coal units. In addition, operation of the Cumberland unit(s) beyond 2026 likely would result in cascading delays for the later planned retirements in TVA's phased 2035 coal fleet retirement plan and could delay TVA's plans to integrate more solar assets into the system.

c. **Does TVA anticipate that the utility-scale solar installations would be located on existing brownfield sites or in greenfield locations or both?**

Response: As stated in EIS Section 2.1.5.2.2, TVA typically utilizes Power Purchase Agreements (PPAs) with third-party developers for its solar facilities. Since TVA also has the option to construct and own ("self-build") these facilities, solar and storage facilities constructed under Alternative C could be a combination of PPAs and self-built facilities. For modeling purposes, Alternative C assumes that TVA continues its practice of soliciting competitive bids for new solar and storage PPAs to meet the need determined in this analysis. While site

locations remain unknown, TVA anticipates that a portion of these facilities will need to be physically located in the Middle Tennessee region to maintain grid reliability and stability. To date, most TVA solar facilities have been located on greenfield sites and this trend is expected to continue.

d. **Would potential solar and storage facility locations be adjacent to units of the National Park System, potentially resulting in non-air quality impacts such as visual resources, water resources or others? Additional information regarding associated infrastructure development, such as transmission upgrades and roads, was not included. The significant geographic scope of Alternative C, which includes many (20+) solar and storage facilities within "Middle Tennessee" at locations yet to be determined, makes it difficult to understand the potential effects of these facilities on NPS-managed resources or areas where we have special expertise. (Commentor: US Department of Interior-National Park Service)**

Response: As stated in Section 2.1.5 of the EIS, since exact site locations for solar and storage facilities are not known at this time, additional site-specific tiered NEPA analysis would need to be completed as projects are identified and the scope is further defined if TVA decides to implement Alternative C. The potential impacts to National Park System units would be carefully considered during the evaluation of all of the facilities associated with Alternative C.

See also Section 2.1.6 regarding Alternative C and why it is not TVA's preferred alternative.

18. **Ignoring the generation and climate change impacts of the nearly simultaneous Kingston Fossil Plant Replacement results in an alternatives analysis that overlooks opportunities to address larger grid challenges. (Commentor: Southern Environmental Law Center)**

Response: As detailed in the Purpose and Need section of the Final EIS, TVA is balancing the pace of the clean energy transition with its obligation to provide low-cost, reliable, firm dispatchable power. See the response to *Comment No. 1* for more information.

The impacts of the Kingston retirement and retirement proposal are being addressed through a separate EIS. Both the Cumberland and Kingston EISs tier off the programmatic EIS prepared by TVA for the 2019 IRP. The 2019 IRP EIS addresses the cumulative climate and other environmental impacts of the target supply mix approved in the 2019 IRP. See also *Comment No. 58.*

The Cumberland and Kingston plants provide localized grid support to two geographically separated areas, in the greater Nashville and greater Knoxville metro regions, respectively. Bulk grid support, in the form of ancillary services such as voltage control, is generally a localized requirement.

19. The EIS should analyze the potential for Alternatives A and B to lock-in fossil fuel use and production, along with the associated financial risks, when compared with energy resources with lower GHG emissions. The EIS should consider and disclose whether these alternatives—especially the preferred Alternative A's natural gas combined cycle unit and pipeline—could yield stranded assets due to market and policy factors that

reduce demand for fossil-generated electricity. (Commentors: US Environmental Protection Agency, Southern Environmental Law Center)

Response: As described in the Purpose and Need section in the Final EIS, TVA plans its system per its least-cost planning mandate, specified in the TVA Act and Energy Policy Act of 1992, which requires TVA to consider cost, risk, and environmental responsibility (among other considerations). TVA's 2019 IRP serves as the foundation for the development of TVA's least-cost plan and asset strategy. The IRP included robust scenario analyses to inform how TVA's asset mix would perform across a variety of potential futures. TVA's asset strategy incorporates the strategic direction from the 2019 IRP and includes a combination of solar, gas, and storage asset additions in the near-term, along with coal retirements, all of which work together to drive down system carbon emissions. While there are no current Federal legislative or regulatory requirements affecting TVA that address carbon reductions or clean energy targets, TVA is executing a plan to reduce carbon emissions 70 percent by 2030 (2005 baseline), sees a path to an ~80 percent reduction by 2035, and aspires to achieve net zero emissions by 2050. The decision to build a combined cycle plant at Cumberland will allow for the retirement of a coal-fired unit, facilitate the addition of solar resources onto the system, and advances TVA's stated carbon emission reductions goals.

TVA has a coal PPA, several gas PPAs, and TVA-owned gas units which are set to expire or expected to reach the end of their useful life over the next 10 to 20 years. The need to eventually address replacement of these assets provides TVA with flexibility to adjust future asset additions under a variety of possible scenarios to avoid the potential for stranded assets based on decisions made today. Furthermore, this EIS focuses on generation to replace the first of two retiring CUF units. Delaying consideration of replacement generation for the second unit will allow TVA flexibility to adjust future asset additions based on the most current data and strategy.

20. The Howard H. Baker Jr. Center for Public Policy provided comments advocating that:

- **The U.S. EIA shows that natural gas use in Tennessee has been rising much more rapidly than overall energy use, with especially strong growth taking place to support expanded centralized power generation and industrial applications. Increased utilization of natural gas has taken place because of relatively attractive prices and a smaller environmental footprint compared to coal. The pervasive use of natural gas and the deep investments that have been made to deploy it means that it will continue to be an essential element of the state's overall energy portfolio for the foreseeable future.**
- **As demand continues to grow, the state's economic prospects will hinge on adequate and stable supplies of natural gas, a safe system of distribution and competitive prices for end-users. Energy security is essential to the state's economic viability.**
- **As concerns are growing regarding the capacity of the interstate and intrastate pipeline distribution system that serves the state to meet its needs, especially in the region served by the ETNG pipeline. As supply constraints become more binding, prices will likely rise, interruptions will likely become more common and end-users will be driven toward other more expensive and less environmentally-friendly sources of energy.**

- **The recommendations in the submitted report generally call for additional research that can more deeply inform stakeholders and produce concrete, cost-effective policy initiatives to ensure natural gas can support the state's future growth. A comprehensive natural gas needs assessment should address all of these issues.**

The submittal included an energy security planning report supported by the Tennessee Energy Policy Council on natural gas needs in the state, "Ensuring Natural Gas Capacity to Meet Tennessee's Economic Development Needs." (Commentors: Matt Murray, Howard H. Baker Jr. Center for Public Policy)

Response: Comment noted and TVA confirms receipt of the March 28, 2022 paper "Ensuring Natural Gas Capacity to Meet Tennessee's Economic Development Needs." The Final EIS has been updated in Chapter 1 and at Section 4.1.2 to address this comment.

Regarding concerns related to potential capacity limitations of natural gas pipelines, TVA's natural gas generating fleet features several key advantages that help mitigate fuel supply risks. As described in TVA's 2021 10-K:

- 80 of TVA's combustion turbines (about 80%) were dual-fuel capable, with fuel oil stored on each of these sites as a backup to natural gas
- TVA maintains 1,517,000 mmBtu/day of firm transportation across seven major pipelines
- TVA utilizes natural gas storage services at seven facilities with a total capacity of 7.25 billion cubic feet (Bcf) of firm service and 5.00 Bcf of interruptible service to manage the daily balancing requirements of the nine pipelines used by TVA

Taken together, TVA maintains a robust process for ensuring that a combination of commercial agreements, such as firm transportation (i.e., reserved pipeline capacity) to service TVA CC plants, and backup onsite fuel oil will ensure that TVA's current and future gas generation remains reliable and resilient.

Early deployment of natural gas also helps advance the State's overall energy portfolio such that this portfolio accommodates the inclusion of substantial renewable energy deployment in the future. As provided in the 2019 IRP, an important component of TVA's plan to meet system reliability needs at the lowest system cost is the inclusion of both combined cycle and simple cycle natural gas generators. See Concentric Report, at 6 (Appendix Q of Final EIS). Given the significant amount of solar, battery storage, and DER expected in the medium term, it is prudent for TVA to deploy new dispatchable generation by the time the Cumberland units are retired at the end of their lives. Id. at 6-7. The near term deployment of the gas plant at Cumberland provides a solid foundation for aggressive renewable energy deployment. Id. at 16-20.

***21.* TVA fails to consider a clean energy portfolio alternative. (Commentor: Southern Environmental Law Center)**

Response: The EIS includes detailed consideration of a carbon-free replacement alternative (Alternative C), which would include the construction and operation of solar generation and energy storage facilities. TVA also evaluates, but does not carry forward for more detailed review, other blended alternatives and other renewable energy resources. See EIS Section 2.1.6.

TVA is balancing the pace of its clean energy transition with its obligation to provide low-cost, reliable, and resilient power. The discussion of Purpose and Need and Alternatives in Chapters 1 and 2, respectively, addresses why a clean energy alternative does not meet the goals of the 2019 IRP. Further, the Aging Coal Fleet Evaluation (May 2021) identified 2026 and 2028 as the likely end of life for CUF Units 1 and 2, respectively; and a clean energy portfolio alternative would not be capable of providing firm dispatchable power by 2026. See also response to *Comment No. 1* for more information.

22. TVA should consider a blended alternative for formal analysis that combines the favorable aspects of the clean energy alternatives analyzed with other strategies TVA considered but did not further analyze. Such an approach would leverage energy efficiency and demand response measures to reduce summer and winter peak demand and implement a portfolio of alternatives—microgrids (e.g., fuel cells in Nashville), rooftop and utility scale solar, and energy storage. TVA may be able to lower or remove the need for 1,450 MW of capacity identified in Alternative A and meet its purpose and need on a more expedited timeline than Alternative C. To address one of TVA's core concerns, TVA may be able to reduce transmission upgrade costs associated with alternatives by targeting areas of transmission congestion with energy efficiency, demand response, distributed renewables, and energy storage measures.

The Draft EIS has also failed to consider what can be done between now and when the gas CC plant would come online in 2026. TVA has completely ignored energy efficiency, demand response, and distributed energy as more immediate replacement options that could obviate the need for a gas plant by 2026. TVA should consider the myriad benefits of incorporating energy efficiency and demand response into its proposed alternatives. Energy efficiency and demand response would provide low-cost electricity and peak demand resources that could provide a significant portion of TVA's resource needs. Energy efficiency investment co-benefits include emissions reductions and local jobs and economic development. Based on the performance of energy efficiency measures for other utilities in the Southeast region and nationally, TVA could improve overall system performance with energy efficiency measures.

TVA also errs in concluding that Alternative A – the new fossil gas plant – is "the best overall solution to provide low-cost, reliable, and cleaner energy to the TVA power system. As part of the agency's long-standing claim that gas is an appropriate "bridge fuel" that may eventually lead to more renewables in the Valley, TVA claims in the Draft EIS that proposed fossil gas CC plant will somehow provide the flexibility the utility needs to reliably integrate 10 GW of solar onto the system by 2035 – despite providing no plan for how TVA intends to accomplish this. To the contrary, recent studies –entirely

ignored in the Draft EIS – challenge this assertion, demonstrating that transitioning immediately from coal to renewables like solar and wind makes economic sense. Indeed, as one recent Report notes, the cost of switching from coal to renewable energy has dropped 99% since 2010. Accordingly, rather than proceeding on the premise that the lost Cumberland Plant generation must be replaced by a new form of centralized power, TVA must add the necessary alternative(s) discussed above that will advance its rapid transition to zero emissions through DER, energy efficiency, and related measures that would obviate the need for more centralized power in an environment where energy demand is no longer increasing. (Commentors: US Environmental Protection Agency, Center for Biological Diversity, SELC)

Response: TVA's asset strategy already contemplates the blending of resources system-wide to provide the least-cost, optimal portfolio under a variety of future conditions, including the addition of up to 1,200 MW of new solar generation per year. The decision associated with this EIS is a specific, discrete component of that blend reflected in TVA's asset strategy. See response to *Comment No. 1* and the Purpose and Need section of the Final EIS.

The EIS evaluates Alternative C, which is a blended solar and battery alternative. In addition, TVA evaluates other blended alternatives. See EIS 2.1.6.1. Ultimately, TVA concluded that any such blended alternative would not meet the purpose and need to have 1,450 MW of firm, dispatchable power in commercial operation by 2026, and therefore, did not carry forward those other blended alternatives for more detailed review.

23. The DEIS ignores the fact that TVA customers and ratepayers want clean, renewable power, not new fossil fuel generation. (Commentor: Southern Environmental Law Center, SACE)

Response: When planning for power generation, TVA must consider the views and opinions of all customers within the Tennessee Valley, while maintaining safe, reliable, and low-cost power for our LPCs and the communities TVA serves, consistent with a primary objective of the TVA Act to keep rates as low as feasible. TVA's activities must also comply with the Energy Policy Act of 1992, which directs TVA to use least-cost planning principles for the TVA system. TVA remains committed to fulfilling its statutory responsibilities to the people of the Valley while also striving to meet the goals of the current Administration.

Based on comments received during the scoping period, TVA included a renewable replacement alternative (Alternative C) in the DEIS. TVA further considered public comments on the Draft EIS, including those submitted by TVA customers and ratepayers, regarding a carbon-free alternative.

24. TVA should evaluate as a component of a *hybrid strategy* a scenario where its current annual savings levels (0.06%) increase to 1% over a 5-year period, 2023-2027 (< 0.2% increase per year), and to 1.5% by 2030. Recent experience from other large utilities indicates that these levels are likely to be achievable and cost effective to TVA's customers. The EPA's Energy Savings and Impacts Scenarios Tool (ESIST) can be used to support this analysis by leveraging national data sets of energy efficiency program

performance and impacts, and applying transparent and documented inputs. (Commentor: US Environmental Protection Agency)

Response: See response to *Comment Nos. 1* and 29 and the Purpose and Need Section of Chapter 1.

25. The EIS should provide a more detailed cost breakout for each alternative and details on key assumptions that informed such costs. It should identify the fuel cost changes from each alternative and the total capital costs of building new generation and associated infrastructure like transmission upgrades. (Commentor: US Environmental Protection Agency)

Response: TVA has included a more detailed cost-breakdown in the referenced Cumberland Retirement EIS Alternatives Evaluation, included as Appendix B in the Final EIS. It breaks down the net differences in alternative costs between Fixed & Capital Costs, Production Costs, Transmission Upgrade Costs, and Fuel Supply Infrastructure Costs. It also details the key drivers of higher or lower costs within each category, relative to the lowest cost alternative.

26. **While the closure of the Cumberland plant is correct, it must be replaced with solar and wind energy, because the timetable of our climate crisis will not accommodate the more gradual emissions reductions embodied in your current trajectory, and in the proposal for gas-fired generation to replace the Cumberland plant in particular. Our current understanding of methane leakage in the natural gas industry also indicates that gas-fired generation carries a greater climate impact, nearer to that of coal-fired power, than previously supposed. TVA has a solemn responsibility to curtail its emissions of carbon dioxide, in favor of renewable energy and reducing consumption, as rapidly as technologically possible. Every pound of carbon burned in a TVA-managed generator is a blow struck against the prospects for human flourishing in the century to come. TVA must choose electricity sources that are proportionally concordant with the most recent conclusion of climatologists. (Commentor: Jim Steitz, Sierra Club)**

Response: Your preference for Alternative C has been noted. See responses to *Comments No. 38* and *63* and the revised Section 3.7 of the Final EIS for discussion of climate impacts.

27. TVA should consider whether a reasonable range of alternatives would include additional renewable or non-gas alternatives beyond Alternative C, or that the EIS disclose additional analysis of why these alternatives were removed from consideration. For example, it would be helpful for TVA to provide additional information and analysis supporting the decision to dismiss wind energy from further consideration. As noted above, benefits of non-gas alternatives include not only GHG and non-GHG pollution emissions reduction, but also contributions to domestic energy stability, e.g., renewables are less subject to global price fluctuations than oil and gas. (Commentor: US Environmental Protection Agency)

Response: The Final EIS Section 2.1.7 includes a more detailed discussion of the alternatives that were evaluated by TVA but not carried forward for more detailed review.

See also response to *Comment No. 1* and Section 2.1.6 of the Final EIS.

28. TVA should choose Option C of the Draft EIS and prioritize solar energy over fossil fuels for its economic and environmental advantages. Advocates that TVA should prioritize renewable energy infrastructure. (Commentors: Touch Grass Nash, Sierra Club, Citizens Climate Lobby, Southern Alliance for Clean Energy, Southern Environmental Law Center)

Response: Your preference for Alternative C has been noted. See response to *Comment No. 1* regarding clean energy alternatives. In response to the Grid Strategies and Synapse reports submitted by the commenter, the Concentric analysis notes the Grid Strategies and Synapse reports fail to recognize the difficulty of building inter-regional transmission projects to move wind output from its source to load centers. As the Concentric analysis points out, the Southern Cross transmission line cited in the Grid Strategies report is anticipated to cost approximately $1000/kW for transmission alone and will have taken 17 years from conception to completion (anticipated in 2027), which would not meet TVA's statutory obligations or project goals for timing of the replacement generation. As reiterated in the Concentric analysis, the Grid Strategies assumptions about readily available inter-regional transmission capacity for importing wind energy from neighboring regions for replacement capacity of the CUF are not realistic or economical when compared to other alternatives.

29. **TVA significantly overestimates the quantity of resources needed for Alternative C. Michael Goggin's independent analysis, which uses TVA's publicly available data, shows that the utility's needs are, in fact, significantly lower: 2,638 megawatts of solar (a 12% decrease from TVA's estimate) and 234 megawatts of battery storage (an 86% decrease from TVA's estimate).**

TVA inflates the costs of Alternative C. TVA reports that the solar and battery storage alternative will cost $2.3 billion more than its preferred alternative, the new combined-cycle gas plant. But the utility arbitrarily inflates the cost of the solar and battery storage projects in a number of ways. First, TVA exaggerates the need for so called "extensive" transmission upgrades and ignores the operational benefits that will result from its investment in transmission to support these projects. Second, TVA fails to account for the substantial operational benefits that the addition of battery storage will provide to the TVA system as a whole. Third, TVA ignores the energy stability benefits of protecting customers from the volatility of gas prices.

TVA arbitrarily minimizes the costs of Alternatives A and B. TVA reports that its preferred alternative, Alternative A, is the lowest cost alternative at $737 million less than Alternative B and $2.3 billion less than Alternative C. But the utility arbitrarily minimizes the costs of both gas-plant alternatives in two important ways. First, TVA fails to include the cost of mitigating the GHG emissions from these alternatives at all, even though President Biden has set a 2035 deadline for carbon-free electricity production, and GHG emissions are the most pernicious environmental impact of the proposed gas plants. Second, TVA fails to include the climate impact costs of the proposed gas plants—as determined by the Social Cost of Greenhouse Gas tools—in its cost estimate. (Commentor: Southern Environmental Law Center)

Response: Based on current system analysis, firm and dispatchable generation will need to be in place by 2026 to support the retirement of the first Cumberland Fossil Plant unit, modest system load growth, and the integration and operation of planned intermittent resources. TVA performed a reliability analysis to determine an appropriate combination of solar and storage resources to maintain year-round system reliability in Alternative C. See Section 2.1.5.2.1. of the Final EIS for additional information.

Alternative C includes substantial solar and storage facility construction as well as extensive regional transmission upgrades. Batteries can offset some bulk system upgrades, and this has been included in the analysis. The Final Cumberland Alternatives Analysis (Appendix B) includes refined transmission estimates that has reduced the overall cost of Alternative C; however, it is still significantly more expensive in comparison to Alternative A. Further, operational benefits are reflected in the production cost estimates. Apart from costs, Alternative C requires a large number of solar and storage projects that fail to meet the required 2026 timeline for the retirement of the first unit at CUF.

To account for uncertainties and risk, including the volatility of gas prices, the 2019 IRP included scenarios that are outside of TVA's control but represent possible futures in which TVA may find itself operating. While key modeling assumptions have evolved in comparison to the Current Outlook in the 2019 IRP, all forecasts of major uncertainties, including electric load, natural gas price forecast, and cost of battery storage, are still within the bounds studied in the 2019 IRP.

The Commenter refers to the 2035 target date for carbon-free electricity production, presumably under EO 14008 and EO 14057. TVA must consider executive orders within the context of statutory requirements imposed by Congress when carrying out its mission. Specific congressional requirements apply to TVA under the TVA Act and the Energy Policy Act of 1992. Under the TVA Act, the TVA Board must adhere to the "primary" objective that "power be sold at rates as low as feasible. See 16 U.S.C. § 831n-4(f). Likewise, under the Energy Policy Act of 1992, TVA has an obligation to conduct least-cost planning, "evaluating the full range and cost of existing and incremental resources including new power supplies, energy conservation and efficiency, and renewable energy resources in order to provide adequate and reliable service to electric customers of the Tennessee Valley Authority at the lowest system cost." See 16 U.S.C. § 831m-1. TVA performs this least-cost planning process through its Integrated Resource Plan, last completed and approved by the TVA Board in 2019. TVA's consideration of various generation alternatives in the Final EIS is consistent with the least-cost planning requirements. TVA is complying with these express statutory requirements as it replaces generation from the proposed retirement of the Cumberland coal plant consistent with the target supply mix approved by the TVA Board in the 2019 IRP. Further, within its existing statutory requirements, TVA has announced an ambitious plan for a 70% carbon reduction by 2030, is developing a path to approximately 80% carbon reduction by 2035 and has announced an aspiration to achieve net-zero carbon emissions by 2050, all while planning to retire its aging coal fleet by 2035.

See responses to *Comments No. 38* (TVA's commitment to decarbonization), *65* (Carbon mitigation), *19* (stranded assets and least-cost planning), *22* (TVA's statutory requirements for least-cost planning), and *48* (Legal uncertainty on SCC values) for additional information.

The Concentric Report provides an independent review of TVA's cost estimates, which it concludes are reasonable. The Concentric Report also evaluates the reports submitted with SELC's comments and concludes that the Synapse and Grid Strategies reports include assumptions about critical inputs to the IRP analysis that are optimistic when compared to publicly available data: the availability of low-cost wind imported into the TVA service territory via inter-regional transmission projects, low-cost energy efficiency measures, and unlimited operational flexibility of battery storage resources. See Concentric Report at 8-15 (Appendix Q of the Final EIS).

The Concentric analysis also provides that the Grid Strategies report presents a narrow version of lifetime cost analysis by substituting certain resource characterizations with more optimistic assumptions about critical inputs when compared with publicly available data. See Concentric Report. at 8. In addition, the Synapse report relied upon behind-the-meter solar and storage impacts from TVA's 2019 IRP estimates, but assumed away approximately $479 million worth of costs to drive those levels of adoption, which included providing incentives to participating customers to cover the full incremental cost of installations. It also relied upon a 2020 study of historical cost estimates to support future savings targets in an inappropriate manner as explained in the Concentric report. Id. at 10-11. The Grid Strategy report made similar errors. Id. at 11.

The Concentric analysis also evaluated the Grid Strategies and Synapse reports' assumptions regarding battery storage. Id. at 12-15. These reports anticipate a needed battery storage capacity to replace the CUF facility that exponentially exceeds the current total combined storage capacity for the entire United States. In addition, these reports fail to understand NREL's battery storage cost estimates in reaching their conclusions and assumptions about the long-term capabilities of batteries, and ignore how the use and charging of batteries directly impacts performance and longevity. Neither the Synapse nor the Grid Strategies reports appear to consider battery performance specifications or specify a commercially available technology, which are critically important for system reliability and stability. The number of times a battery is cycled (i.e. dispatched) and the depth of those discharges (i.e. the capacity used when dispatched) impacts a battery's useful life. Therefore, the fixed operations and maintenance expense for battery storage, and the risk of reducing battery storage life through increased operational use are not properly considered in the Synapse and Grid Strategies reports. This uncertainty alone could materially increase the costs of the scenarios they present above the costs they predict. In other words, these reports underestimate the costs of increased solar with battery storage. For these reasons, the Concentric analysis supports the conclusion that Alternative A is a lower cost outcome than Alternative C. Alternative C would not provide for the least-cost alternative. Id. at 21.

Further, in evaluating the feasibility of Alternative C, the Concentric analysis notes that "the Grid Strategies report assumes no transmission upgrades would be necessary because a

combination of solar, battery storage, and other devices like a synchronous condenser can be installed in strategic locations to avoid costly system upgrades," but to the contrary "because power plant retirements fundamentally change the flow of power on the transmission system, a holistic analysis of the transmission system is needed to confirm the necessary remedies.". Thus, the Grid Strategies assumptions are unreasonable because it would be reasonable to expect that the retirement of CUF (one of the ten largest coal plants in the U.S.) would need transmission system upgrades to accommodate the integration of solar and battery storage integration. Similarly, the Concentric analysis provides that the Synapse report's recommendations are "simply not viable or based on a rigorous approach that meets system reliability requirements."

30. The EPA recommends that TVA reach out to the National Renewable Energy Lab, (NREL) for a consultation on grid integration. NREL can perform studies to address reliability under high-renewable energy scenarios. (Commentor: US Environmental Protection Agency)

Response: Comment has been noted. TVA is balancing the pace of clean energy transition with its statutory obligation to provide low-cost, reliable, and resilient power. TVA performed a reliability analysis to determine an appropriate combination of solar and storage resources to maintain year-round system reliability in Alternative C. See Section 2.1.5.2.1 of the Final EIS for detailed information on this study. Resource option costs for gas units are informed by vendor quotes and renewable and storage costs are informed by recent RFP submissions in the near-term and NREL forecasts over the mid-to-long term.

TVA possesses expertise in evaluating strategies that would allow for various renewable energy scenarios to be integrated in a manner that preserves the high reliability of the transmission system. As part of its IRP and ongoing planning or compliance processes, TVA performs capacity expansion, production cost, and transmission steady state and dynamic stability modeling. These studies look at various time horizons, with longer-term capacity expansion covering as far as a 20-year horizon (such as the IRP). TVA also performs sub-hourly studies, such as the Flexibility Study and Intermittent Resources Study, details of which can be found in the appendix of the 2019 IRP.

The Concentric Report reviewed NREL cost forecasts and FOM scenarios, as well as an NREL study analyzing the effects of increased wind and solar penetration on the operation of bulk power systems and concluded that "this amount of renewables generation on the system would require a mix of flexible conventional generation and grid storage, additional transmission, more robust load response measures and changes to power system operations," and thus "a transformation of the electricity system would need to occur to make this future a reality."

31. The FEIS should consider how each alternative compares with scenarios consistent with achieving science based GHG reduction goals, rather than solely against a "business as usual" baseline of high fossil fuel use. The DEIS compares the alternatives with a No Action baseline of continued operation of two coal-fired generation units, rather than evaluating how these alternatives compare with actions the United States must take in order to meet GHG reduction goals. If TVA continues to use the No Action

Alternative, TVA should address the likelihood that the plant would still need to be replaced within the planning horizon and/or would be required to address its substantial GHG emissions. The EIS should account for the potentially substantial costs associated with both complying with the ELG rule and with other operation and maintenance needed to keep the plant running, which includes ensuring proper remediation and management of coal ash. (Commentors: US Environmental Protection Agency, Clean UP TVA Coalition)

***Response*:** Under CEQ's regulations at 40 CR 1502.14, the alternatives section should present the environmental impacts of the proposed action and the alternatives in comparative form based on the information and analysis presented in the sections of the affected environment and the environmental consequences. CEQ's regulations require agencies to include the no action alternative in the alternatives section. The No Action Alternative provides, among other things, a benchmark, enabling decisionmakers to compare the magnitude of environmental effects of the action alternatives. As explained in Section 2.1.1 of the Final EIS, CUF has significant future capital needs to support compliance with the USEPA CCR and ELG rules.

See response to *Comment No. 32,* which addresses the ELG rule.

32. Both Cumberland coal-fired units have already filed a Notice of Planned Participation to comply with the EPA's 2020 Steam Electric Effluent Guideline rule (ELG rule), which indicates that TVA will permanently cease coal combustion by 2028 at both units. In addition, Unit 2 has an indicated retirement date of 2026 in the EPA's NEEDS database, which is compiled using public filings, such as Energy Information Administration's Form-860. However, the DEIS considers the benchmark counterfactual to be a No Action Alternative where both units operate past 2040. TVA should explain these varying representations. Presumably there are additional costs associated with keeping the coal operating and it is not clear whether this is accounted for in the DEIS, along with other potential conflicts. Such costs should be disclosed in detail. To ensure consistency, the EPA recommends that TVA align the modeling for GHG calculations with the other plans in the document. (Commentor: US Environmental Protection Agency)

Response: Under CEQ's regulations, the alternatives analysis should include a "no action" alternative. 40 CFR § 1502.14. In instances involving federal decisions on proposals for projects, the No Action "would mean that the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward." CEQ's Forty Most Asked Questions Concerning CEQ's NEPA Regulations, Question 3, 46 Fed. Reg. 18026, 18027 (1981). In this case, if the Proposed Action is not implemented and new replacement generation is not put in place, TVA would need to continue operating the CUF coal-fired units.

Planned retirement dates of 2026 and 2028 for the two CUF units are based on the Aging Coal Fleet End-of-Life Evaluation. The evaluation identifies these retirement dates based on the assumption that TVA would not spend money on replacing or maintaining aging unit components or on equipment necessary to meet requirements under future regulations such as the ELG Guidelines and GHG emission rules. However, if replacement options are not

available, TVA would have to make these expenditures and delay the retirement of the CUF units.

As explained in the environmental consequences review of the No Action Alternative (EIS Section 3.4.2.1): "in order for the existing CUF units to remain operational, repairs and maintenance would be necessary in order to maintain reliability." The need for "additional spend at CUF to maintain reliability and meet known environmental compliance obligations (e.g., ELG Rule)" is also explained in the Alternatives Evaluation document (Slide 17 of Appendix B in the Final EIS).

As the Final EIS Chapter 1 explains, to operate CUF units 1 and 2 beyond 2028, substantial plant modifications would be required to comply with EPA's Coal Combustion Residual (CCR) and Steam Electric Effluent Limitations Guidelines (ELGs) regulations. TVA submitted a Notice of Planned Participation (NOPP) to TDEC on October 6, 2021, to preserve the option of participating in the retirement subcategory by ceasing coal combustion by 2028; as noted in the NOPP, pursuant to Part 423.19(i)(1) of the ELG Rule, TVA may elect to transfer between applicable limitations at a later date via a subsequent NOPP. The 2020 ELG rule allows for certain transfers between compliance options, known as subcategories, in the rule. While TVA has participated in the subcategory for facilities planning to cease coal combustion by December 31, 2028, ("retirement subcategory"), TVA may choose at a later date to transfer to another subcategory that will support plant continuing operation past 2028. Under the No Action Alternative, which would require continued operation of the two CUF units, TVA could submit a new NOPP to utilize a different compliance option under the 2020 ELG rule.

While EIA's Form-860 includes a field for "Planned Retirement Year," TVA asset retirements are subject to environmental review, i.e., the CUF EIS, and TVA Board Approval. As explained in the Final EIS Section 1.1, replacement generation must be in place prior to the retirement of the first unit. Without the Proposed Action's replacement generation, TVA would have to delay the planned retirement of the CUF units. In that case, TVA would file an updated EIA Form-860 to reflect a later retirement date for the CUF units, for additional information see TVA's Aging Coal Fleet Evaluation at https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/aging-coal-fleet-evaluation2eeb5bd7-1983-4d03-ac5b-c105e2686d07.pdf?sfvrsn=3425c191_3) and TVA's Cumberland Alternatives Analysis (see Appendix B to the Final EIS).

Accordingly, the No Action Alternative is not a counter-factual scenario. Rather, it is an appropriate baseline because it accurately reflects what would happen if the Proposed Action did not take place.

AIR QUALITY

Greenhouse Gas Emissions and Social Cost of Carbon

33. A variety of State and Federal regulations are likely to affect the power sector in the coming decades. In general, these regulatory efforts aim to reduce fossil fuel emissions. There are also forecasts of declining costs and increasing adoption of renewable generation as well as increased electricity demand from increased electrification. The EPA recommends thorough consideration of these trends, transitions, and risks in planning any large-scale power sector project. Coal and natural gas combustion are relatively mature technologies that have limited potential for further cost-saving

innovations. Renewable energy may retain greater potential for further cost reductions via innovation and learning-by-doing. Similar remaining opportunities for further cost reductions in coal and natural gas technologies may be comparatively rare and expensive to exploit.

In Alternatives A and B, the EPA recommends TVA consider the long-term financial liabilities associated with fuel price uncertainty, projections of falling technology costs, and how mitigation may reduce risk. Investing in long-lived combustion turbines due to inaccurate expectations about the costs of alternatives like solar may lead to higher overall costs. Moreover, long-lived fossil assets may become uneconomic faster than expected if alternatives and mitigation are not fully considered. (Commentor: US Environmental Protection Agency)

Response: To account for the types of uncertainties and risks referenced by the commentor, the 2019 IRP included scenarios that are outside of TVA's control but represent possible futures in which TVA may find itself operating. Additionally, Section 8.2 of the 2019 IRP outlines the variety of sensitivity analyses performed. TVA identified and assessed a list of uncertainties that could alter the future operating environment and affect the cost of electricity and/or mix of optimal resources. See Sections 6.1.1 and 6.3.3 of the 2019 IRP for further information.

TVA is planning to expand future solar facilities to 10,000 MW by 2035, complemented with battery storage, in order to meet customer and system demand. Incorporating these volumes of intermittent resources must be paired with year-round dependable capacity. A natural gas plant would provide firm, flexible capacity, reduce emissions, and help ensure system reliability during the upcoming clean-energy generation changes. Natural gas-fired units, including the addition of a CC plant at Cumberland, enable the retirements of older coal-fired units with higher carbon intensity, enable greater levels of renewables on the system, and provide reliability support as we integrate intermittent renewable generation to the system. Another key consideration is that modern CC plants, such as the proposed CC at Cumberland, typically produce about 65-70 percent fewer CO_2 emissions per MWh than TVA's legacy coal fleet.

While solar and batteries are becoming more competitive, collectively they are still more expensive compared to natural gas alternatives, and supply chain challenges are introducing both cost and timeline risks for solar and battery resources. TVA is exploring partnerships with other federal agencies and peer utilities to advance the research and development of future carbon-free technologies, such as advanced nuclear, carbon capture and sequestration, hydrogen as a fuel, and long-duration storage for potential future deployment in the 2030s and beyond.

TVA appreciates the comments related to mitigation. If Alternatives A is selected, TVA will ensure that proposed plant design enables future modifications for carbon capture and will incorporate combustion equipment that can utilize hydrogen fuel blending as the technologies mature. TVA anticipates the efficiency and effectiveness of these systems to improve in the next several years and will allow for better decisions when adequate storage locations or pipelines are identified for both delivery of hydrogen and the disposal of captured CO_2. Additional equipment could be incorporated into the coal plant site after the plant is closed and its site remediated (under Alternative A). Once a viable hydrogen fuel source is identified, TVA would prepare a supplemental NEPA analysis.

In a separate effort TVA is planning to explore deep geology at or near multiple TVA locations, including Cumberland, for suitability/capability of carbon storage. If these efforts do not yield acceptable storage reservoirs locally, then onsite use of CO_2 as a feedstock for a utilization process or transportation offsite would be required. Currently no utilization of CO_2 at an appropriate scale is available that could be evaluated for this project. Pipeline routes have not been identified at this time; however, the most promising geological location would appear to be in the Coastal Plains to the south based on a national assessment of geologic storage by the USGS (USGS 2013).

34. The EPA also recommends TVA adopt the proposal for the preferred alternative to use an electrified natural gas compressor. (Commentor: US Environmental Protection Agency)

Response: TVA anticipates using an electrified natural gas compressor(s) for any gas compression facilities installed at the Cumberland site. The pipeline component of Alternative A does not include any new compression facilities.

35. TVA should also adopt the recommendations of the EPA's Methane Challenge program to reduce potential GHG emissions attributable to the project. In addition, TVA should incorporate such mitigation measures into the proposed terms and conditions required as part of the pipeline contract. (Commentor: US Environmental Protection Agency)

Response: TVA has executed a precedent agreement with Tennessee Gas Pipeline to construct the natural gas pipeline lateral. Tennessee Gas Pipeline is a subsidiary of Kinder Morgan, which is a member of the ONE Future Coalition and has joined the Methane Challenge program as a ONE Future commitment option Partner. As a member of Methane Challenge, Kinder Morgan reports detailed data on methane emissions and voluntary methane reductions across its operations to Methane Challenge annually. As a ONE Future commitment option Partner, Kinder Morgan has committed to achieve a 0.32 percent methane intensity rate by 2025.

36. The Draft EIS also seriously underestimates the risk of methane leaks, concluding that leaks from the plant and the pipeline will be extremely minor. TVA must meaningfully address the methane emissions this infrastructure will bring over the lifetime of these projects and the devastating impacts of that methane on the climate in light of methane's extreme climate impacts. (Commentor: US Environmental Protection Agency)

Response: Based on analysis of EPA data, the American Gas Association indicates that methane fugitive emissions across the entire natural gas supply chain (wellhead-transportation-storage-combustion) are typically around 1.0%, and leakage rates previously estimated by EPA are around 1.4% (American Gas Association 2021). There are numerous ongoing industry and government efforts to further reduce methane leakage throughout the natural gas supply chain, resulting in a 16 percent reduction in total methane emissions from natural gas systems between 1990 through 2019, a period when gross natural gas withdrawals almost doubled (American Gas Association 2021).

Further, the Final EIS has been updated in Section 3.7.1.1.8. to provide additional analysis and discussion of the potential for methane leaks as part of the LCA analysis, and the potential environmental consequences should those leaks occur.

37. The EPA recommends that TVA consider the use of switchgears that are SF6-free for the proposed alternatives, as well as system-wide, as larger switchgears become available (Commentor: US Environmental Protection Agency).

***Response*:** The switchgear units that would be utilized for this project are manufactured to meet industry standards. As stated in Section 3.7.2.3.3 of the Final EIS, some older existing electrical equipment may contain the GHG sulfur hexafluoride (SF6) gas (e.g., electrical switchgear, circuit breakers), which could have minor leaks, mostly associated with maintenance or long-term equipment degradation. Additionally, where newer equipment has been installed or is proposed, along with more efficient operation and maintenance techniques, and leak detection, these features would minimize sulfur hexafluoride emissions. The only other market-available switchgear option (vacuum) does not provide interruption to support NERC Protection and TVA reliability standards to provide safe reliable power for the Tennessee Valley. A system-wide review of SF6 switchgear conversion would be outside the scope of this analysis; however, TVA actively monitors evolving technology for future consideration.

38. The Final EIS (FEIS) should include a discussion of whether and to what extent the estimated GHG emissions from the proposed alternatives are consistent with achieving science based national GHG reduction targets and any relevant state or local goals. Also, because the proposed action is consistent with the goals of the 2019 Integrated Resource Plan (IRP), TVA's analysis should include a discussion of how the proposed action and 2019 IRP will achieve GHG reduction targets. Additionally, the EPA recommends that the 2019 IRP should be updated to include the actions that TVA will take to align with its 2021 Strategic Intent and Guiding Principles and national science-based goals (Commentor: US Environmental Protection Agency).

***Response*:** The Final EIS Section 3.7.1.1.8 describes how the alternatives evaluated are consistent with relevant GHG reduction targets. TVA is committed to supporting the Administration's decarbonization goals and is executing a plan that will continue to reduce emissions through implementation of the IRP. TVA is already a leader among utilities in carbon reduction today. TVA is executing a plan to achieve a 70 percent carbon reduction (from the 2005 baseline) by 2030 and sees a path to an ~80% reduction by 2035, which can be achieved using existing technologies while maintaining reliability and affordability, as TVA continues to evaluate additional means of achieving deeper decarbonization. As TVA works to achieve its aspiration for net-zero carbon by 2050, TVA can make a unique contribution to President Biden's goal through TVA's innovative developments in emerging technologies including energy storage, electric vehicle evolution, decarbonization options, connected communities, regional grid transformation, and advanced nuclear solutions. TVA is investing in research and development with peers to achieve utility-scale testing and development of these new technologies, and is working to partner with federal agencies and others to lead the nation in deployment of these new technologies.

The carbon reductions from the alternatives evaluated in this EIS are consistent with the goals and recommendations of the 2019 IRP and TVA's decarbonization aspirations outlined in the 2021 Strategic Intent and Guiding Principles. The IRP serves as TVA's mechanism for meeting least-cost planning obligations. Under the Energy Policy Act of 1992, TVA is mandated to plan its system using least-cost planning, which seeks to balance the following key goals: low cost, risk informed, environmentally responsible, reliable, diverse, and flexible. Further, the TVA act

requires TVA to sell power at “rates as low as feasible.” The carbon reductions from the action alternatives are consistent with President Biden's goal of achieving net zero emissions economy-wide by 2050. See Section 3.7.1.1.8 of the Final EIS for more information.

TVA continues to explore other ways that it can accelerate its emissions reductions, while maintaining safe, reliable, and low-cost power for its LPCs and the communities TVA serves, consistent with the statutory obligations to keep rates as low as feasible and maintain high reliability. TVA remains committed to fulfilling its statutory responsibilities to the people of the Valley while also striving to meet the goals of the Administration. Resource mix changes outlined in TVA’s 2021 Strategic Intent and Guiding Principles, such as evaluating the impact of retiring the coal fleet by 2035 and adding 10,000 MW of solar by 2035, are consistent with the results, target power supply mix recommendation, and near-term actions outlined in the 2019 IRP. TVA committed to initiating its review of the next IRP no later than 2024 and will honor this commitment. See response to *Comment No. 58* for more discussion regarding TVA’s IRP process.

39. Addressing climate change is a federal policy priority. ... To address the climate crisis, President Biden ordered the entire federal government to take decisive, bold action—including swiftly decarbonizing the electricity sector. Executive Order 14008 establishes the goals of “net-zero emissions, economy-wide, by no later than 2050” and “a carbon pollution-free electricity sector no later than 2035.” In Executive Order 13990, President Biden reestablished the Interagency Working Group on the Social Cost of Greenhouse Gases and instructed agencies “to capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account.” TVA “may not simply disregard an Executive Order. To the contrary, as an agency under the direction of the executive branch, it must implement the President’s policy directives to the extent permitted by law.” (Commentor: Southern Environmental Law Center)

Response: TVA is committed to implementing the President’s policy directives to the extent permitted by the provisions of the TVA Act and the Energy Policy Act of 1992 discussed in the previous comment, and other such applicable provisions. See Final EIS Section 3.7.1.1.8 as well as response to *Comments No. 46* and *38* for discussion on how TVA's goals align with the Administration's federal climate policy and response to *Comment No. 38* for TVA’s response regarding President Biden’s electric sector decarbonization executive order.

40. The draft EIS falls well short of NEPA’s requirements. First and foremost, TVA seeks to minimize the environmental effects of expanding its fossil fuel portfolio by burying the expected emissions within the overall TVA fleet. This approach violates NEPA by failing to highlight the distinct effects of this gas plant. See, e.g., 350 Mont. v. Haaland, 2022 U.S. App. LEXIS 8918, *38 (9th Cir. Apr. 4, 2022). By failing to independently consider the emissions of this plant – separate and apart from TVA’s overall emissions – the Draft EIS fails to comply with NEPA. (Commentors: Center for Biological Diversity)

Response: Consistent with NEPA requirements to take a hard look at the effects of the alternatives, the Draft EIS and the Final EIS provide the estimated emissions from each alternative, individually, in addition to TVA system-wide GHG emissions expected under each alternative. The individual alternative annual operational emissions and the net change in emissions for each alternative are presented in Table 3.7-5 in the Draft EIS and Table 3.7-3 in

the Final EIS. The Final EIS has been updated in Section 3.7 to also include results of a GHG Life Cycle Analysis (See Appendix I) performed for the No Action and Action Alternatives, independently for each alternative, as well as system-wide. See also the response to *Comment Nos. 42 and 54* for information on the value of TVA's system-based GHG emissions analysis.

41. In the Draft EIS TVA also refuses to quantify upstream GHG emissions. This also runs flatly contrary to NEPA's requirements. E.g. Sierra Club v. FERC, 867 F.3d 1357 (D.C. Cir. 2017); 40 C.F.R. § 1508.1(g). NEPA mandates that an agency fully consider both indirect and cumulative effects, and upstream emissions fall well within the scope of such effects. Moreover, as the Court made clear in Sierra Club, an agency may not decline to address this issue on the grounds that these emissions are too difficult to quantify, as "reasonable forecasting" is plainly available. Sierra Club, 867 F.3d at 1374. Finally, while the EIS includes data based on the Biden Administration's Social Cost of Carbon metric, this approach woefully undervalues the costs that additional GHG emissions will impose on the local and global environment. As the academic literature shows, agencies should be relying on a much lower discount rate – even as low as 0% - to properly account for the impact of GHG emissions on future generations. Accordingly, TVA must evaluate the costs associated with the gas plant alternatives using significantly more conservative assumptions than those contained in the Draft EIS. (Commentor: Center for Biological Diversity)

Response: The Final EIS provides detailed analysis of GHG emissions, including direct, indirect, and cumulative effects. Section 3.7 of the Final EIS has been updated with results from a Life Cycle Analysis (LCA) that incorporates direct and indirect effects of the gas pipeline including upstream and downstream emissions. The methods, assumptions, and results of the LCA are provided in Appendix I.

The social cost of GHGs estimates in the Final EIS are based on a 3% discount rate, which is consistent with current federal guidance. TVA disagrees that a discount rate as low as 0% should be used because language in the Interagency Working Group (IWG) January 2021 document regarding social costs of GHGs states that a 3 percent discount rate is appropriate. The following is excerpted from that document: "*The 3 percent value was included as consistent with estimates provided in OMB's Circular A-4 (OMB 2003) guidance for the consumption rate of interest. The IWG found that the consumption rate of interest is the correct discounting concept to use when future damages from elevated temperatures are estimated in consumption-equivalent units as is done in the IAMs used to estimate the SC-GHG (National Academies 2017)."* The lowest discount rate provided in this document with associated SC-GHG values is a 2.5% discount rate and a higher rate of 5% is also provided. The IWG document indicates that while lower discount rates (*i.e.,* even lower than 2.5%) warrant consideration, no update of the IWP has been issued at this time. In addition, within the federal government, future costs and benefits are commonly discounted at an annual rate of 3 percent. See response to *Comment Nos. 46 and 47* for additional information.

42. The EIS should provide further narrative explanation of the emissions trends in the GHG analysis presented in DEIS Tables 3.7-3 and 3.7-4. Specifically, the EIS should explain why the No Action Alternative emissions generally decrease until 2034 and then increase thereafter. Additionally, the EIS should explain why Alternative C (solar and

storage) emissions are higher than No Action Alternative emissions through 2024. An explanation should be included for the similarity between Alternatives A, B, and C emissions in 2041. In this context, given that there are substantial differences in the monetized costs of CO_2 emissions across the alternatives, TVA should address and justify its conclusion that, "The SCC results for TVA system-wide effects essentially show that all the alternatives are very close regarding their overall GHG effects…" (Commentor: US Environmental Protection Agency).

Response: The Final EIS provides further discussion of GHG emissions in Sections 3.7 and a social cost of GHG emissions (including carbon) comparison of alternatives over time in Table 3.7-3 of Section 3.7. Since the decision to replace Cumberland Fossil Plant is one piece of TVA's overall asset strategy, the GHG analysis projects system-wide emissions and reflects likely changes in the portfolio that may occur after the Cumberland decision based on least-cost planning (formerly Tables 3.7-3 and 3.7-4 in the Draft EIS, currently Tables 3.7-12 and 3.7-13 in Section 3.7 of the Final EIS). For example, in the near term, TVA is evaluating the impact of retiring the aging coal fleet by 2035 and expects to add 10,000 MW of solar by 2035, consistent with the 2019 IRP and May 2021 Strategic Intent and Guiding Principles approved by the TVA Board. Any retiring capacity, or need for new capacity to address load growth, would require firm, dispatchable generation. Once TVA has fully retired the existing coal fleet and added 10,000 MW of solar, future incremental load growth is served with the lowest cost resources, which under current assumptions includes additional natural gas-fired generation. This trend is consistent across the emissions listed for the No Action Alternative and all three action alternatives. The slightly higher emissions in Alternative C compared to the No Action Alternative through 2024 shown in the DEIS was based on the model re-drawing outages to arrive at an economic dispatch that falls within the accepted tolerance. The same alternative can result in slightly different results each time the model solves for an optimal solution. Given there are no capacity plan differences between all the alternatives for the first few years, the table has been revised in the Final EIS and now reflects that Alternatives A, B, and C each would have substantially lower GHG emissions than the No Action Alternative.

TVA's path to ~80% carbon reduction by 2035 primarily utilizes existing, cost-effective technologies. TVA is investing in the research and development of new carbon-free technologies, such as small modular reactors (SMR), long-duration storage, and carbon capture, to enable their potential deployment in the 2030 to 2040s. Federal support to incentivize the development of clean energy technologies will be crucial to finding a pathway to net-zero that is economical and reliable.

CO_2 emissions in 2041 for all action alternatives are reflective of total system emissions derived from a least-cost dispatch of the diverse generating assets available in each alternative. In all action alternatives, the TVA system's carbon emissions are greatly reduced as a result of TVA's plans to retire the coal fleet by 2035 and add 10,000 MW of solar by 2035. In the case of Alternative A, the Cumberland CC would be one of the most fuel-efficient assets in TVA's coal and gas portfolio and therefore it would run frequently and offset other less-efficient gas units which are higher cost and higher carbon-emitting. In the case of Alternative C, the additional solar and battery storage assets would reduce reliance on carbon-emitting resources during daylight hours and when the batteries are discharging but are not available in all hours to serve load needs. The TVA gas fleet backstops the additional solar and storage in hours they are not available but is less efficient without the addition of the Cumberland CC.

43. The EIS should explain why the GHG analysis considers a 20-year horizon to 2041 and whether this time horizon is sufficient to analyze trade-offs among emissions trajectories. Gas-powered combined cycle units had an average retirement age of 30 years in 2018, suggesting that a 20-year horizon is too short. To address this issue and related analytical shortcomings, it is recommended that TVA perform a comparison of the proposed projects' long-term generation impacts with energy use trajectories consistent with achieving science-based targets for GHG reduction. For important context, it is also recommended that further explanation be provided of TVA's plans for replacing the remaining lost capacity from retiring the Cumberland coal plant (Commentor: US Environmental Protection Agency).

Response: Resource selection, and the overall portfolio in each alternative, is based on economics and accounts for the projected lifetime of each resource type. When selecting a resource, the capacity expansion model calculates each resource's cost and allocates that cost over its projected lifetime. This allows comparison of resources that have different expected lifespans. Consistent with industry-standard IRP time horizons, TVA performs economic studies, such as the CUF Financial and Systems Analysis, over a 20-year period. Forecasting production beyond a 20-year time horizon introduces significant uncertainties that can jeopardize the accuracy of results.

Based on comments received, and to ensure a like-for-like comparison of alternatives, TVA has included a life cycle analysis in the Final EIS, which accounts for expected 30-year resource lifespans for the gas-fired units and a 20-year lifespan for solar and storage that is prorated to 30 years for consistency in comparing alternatives. See the GHG Effects from Direct and Indirect Emissions – Life Cycle Analysis discussions in Sections 3.7.2.3.1 and 3.7.2.5.1 in the Final EIS and Appendices H and I. As noted in Chapter 1 of the Final EIS, planning for the replacement generation for the second retired CUF unit would be deferred to allow additional time for the assessment of specific types and locations of that generation. Additional information is provided in responses to *Comment No. 38* (Carbon Trajectory) and *Comment No. 42* (Asset Strategy).

44. The EPA recommends that TVA avoid expressing project-level GHG emissions as a percentage of national or state GHG emissions. The DEIS approach of comparing project-level emissions to national and state emissions diminishes the significance of substantial project-scale GHG emissions. This approach is also misleading given the nature of the climate policy challenge to reduce GHG emissions from a multitude of sources, each making relatively small individual contributions to overall GHG emissions. Instead, the EPA recommends that the FEIS include a discussion of whether and to what extent the estimated GHG emissions from the proposed alternatives are consistent with taking action to achieve science based national GHG reduction targets and any relevant state or local goals, as noted above. Since the proposed action tiers off the 2019 IRP, this analysis should include a discussion of how the proposed action and 2019 IRP will achieve GHG reduction targets (Commentor: US Environmental Protection Agency).

***Response*:** See responses to *Comment No. 38, 40,* and *49*. Since the current state of climate science does not allow for specific linkage between particular GHG emissions and particular localized impacts, the proportionate estimate of GHG emissions serves as a reasonable proxy for assessing potential climate impacts. The comparison of the project's emissions to state,

national and global emissions allows TVA to contextualize the projected emissions. The CEQ's August 2016 *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* discusses using a proposed action's emissions as a percentage of sector, nationwide, or global emissions in deciding whether or to what extent to consider climate change impacts under NEPA. Although it states an agency shouldn't limit itself to this type of analysis, it doesn't completely discount it. In the Final EIS, TVA goes beyond this type of analysis and includes two types of GHG life cycle analyses, including emissions and associated social costs.

Consistent with EPA's recommendation for other recent EISs, TVA has revised the Final EIS to better describe how its action to retire coal-fired generation and the alternatives to replace that generation with less carbon-intensive sources helps achieve the GHG reduction targets discussed in the 2019 IRP and the TVA Strategic Intent and Guiding Principles Document (May 2021), as well as Administration goals. Additionally, TVA has followed EPA's recommendation in conducting an analysis comparing the social cost of GHGs emitted under each alternative in Section 3.7.

45. The DEIS indicated that a system-wide model was used to generate the assumptions for displacement of higher emitting alternative fuels and the calculations of GHG emissions associated with each alternative, but the DEIS does not provide specific details on this model. The EPA recommends that the details of the displacement modeling be fully specified and explained in the FEIS so that the underlying uncertainty and assumptions are clear. For instance, the GHGs in the No Action Alternative that are being displaced should be quantified and monetized using the SC-GHG. It is not clear how this modeling comports with broader TVA system plans that include additional renewables in later years, or whether the costs of keeping coal operating are reflected in the analysis. Where possible, peer reviewed methods should be used for modeling. (Commentor: US Environmental Protection Agency)

Response: Consistent with EPA's recommendation, the Final EIS provides a more detailed discussion of the methodology used to analyze GHG emissions in Section 3.7.2, including how the modeling accounted for displacement of higher emitting alternative fuels and GHG emissions calculations for each alternative. Aligned with TVA's IRP and strategic direction, capacity and resource planning follows least-cost principles to develop a system-wide asset strategy that identifies the power resources needed to meet system demand with appropriate reserve margin. The process requires multiple inputs, including but not limited to electricity demand, fuel and power costs, resource costs, environmental regulations, asset operating characteristics, target planning reserve margin, and transmission considerations. Key assumptions are validated and compared against industry benchmarks, studies, and forecasts, then modeled with commercially available tools. TVA used industry standard models, System Optimizer (licensed by ABB) and Aurora (licensed by Energy Exemplar), for capacity optimization and production cost to model the alternative scenarios over a 20-year period. System Optimizer calculates the least-cost plan while accounting for load plus reserve margin targets while Aurora models the economic dispatch of the fleet. System Optimizer is the same optimization model used in the 2019 IRP (see section 6.3.1 of the 2019 IRP for additional information).

See response to *Comment No. 58* for more information on TVA's approach to developing assumptions and modeling uncertainties in the IRP and ongoing internal planning.

See response to *Comment No. 42* (Asset Strategy - reflected in least-cost planning modeling). TVA's SC-CO2 analysis utilizes the carbon dioxide emissions based on the same model runs used for financial analysis.

The CUF Alternatives Evaluation (Appendix B of the Final EIS) includes all system costs associated with each alternative, including additional spend at CUF to maintain reliability and meet known environmental compliance obligations (e.g., ELG Rule).

46. The EPA recommends disclosure and consideration of all direct and indirect project GHG emissions, including upstream and pipeline emissions. TVA should analyze GHG emissions in the context of national and state GHG reduction targets and policies. TVA's revised analysis should inform and improve TVA's consideration of mitigation measures and climate adaptation. The EPA recommends quantification of all reasonably foreseeable direct and indirect GHG emissions (e.g., carbon dioxide (CO2), methane, and nitrous oxide (NOx)) attributable to the proposed action and alternatives. Quantification should include upstream emissions (exploration, extraction, processing, and pipeline transmission), plant and pipeline construction emissions, and combustion-related methane emissions. Upstream methane emissions from coalbeds and natural gas systems are likely to be substantial despite the increased regulation, improved practices, and new technologies mentioned in the DEIS. Research also suggests that these methane emissions are larger than previously expected. (Commentors: US Environmental Protection Agency, Southern Environmental Law Center, Southern Alliance for Clean Energy).

Response: In the Final EIS, TVA performed a life cycle analysis (LCA) for each alternative. The results of this LCA are summarized in Tables 3.7-8 through 3.7-13 and additional details of the LCA process are provided in Appendix I. Consistent with commenters' recommendations, the LCA incorporates direct and indirect emissions from upstream and downstream sources associated with each action alternative and the No Action Alternative over the 30-year lifetime. The Final EIS also presents upstream and ongoing combustion and non-combustion GHG emissions in Table 3.7-8 and Table 3.7-9 consistent with the system-wide 20-year modeling approach to best illustrate differences in system-wide GHG emissions between alternatives in the Final EIS.

Based on the results of the LCA, TVA has included an analysis of the social cost of GHG emissions, including carbon dioxide, methane, and nitrous oxide, for the No Action and action alternatives. This information is presented in Final EIS Section 3.7.2 and Appendices H and I. See also the response to *Comment Nos. 33 and 38*.

47. The EPA recommends the February 2021 interim SC-GHG estimates developed by the Interagency Working Group (IWG) on the SC-GHGs as the most appropriate current estimates for use in policy analysis until an improved estimate of the impacts of climate change can be developed based on the best available science and economics taking into consideration recommendations from the National Academies of Sciences, Engineering, and Medicine (National Academies 2017) When applying SC-GHG estimates, TVA should disclose the associated assumptions (e.g., discount rates) and uncertainties, which are lacking in the current application in the DEIS. Furthermore, the EPA recommends against

characterizing any SC-GHG estimates as an "upper bound" of climate change impacts in the FEIS. The IWG's 2021 Technical Support Document presents a range of estimates and discount rates and discusses the uncertainties and the many categories of damages that are not yet reflected in existing SC-GHG estimates. Data and modeling limitations therefore naturally limit the SC-GHG estimates to be a partial accounting of climate change impacts, making it incorrect to assert an upper bound using only one of the SC-GHG estimates. (Commentor: US Environmental Protection Agency)

Response: TVA's analysis is consistent with the estimates developed by the IWG, which are the most current estimates for use in policy analysis. As noted in the title, Table 3.7-3 of the Final EIS uses IWG SC-CO2 values based on a 3% discount rate at the average statistic. TVA has updated the Final EIS to clarify which discount rate and statistic are being presented. Consistent with EPA's recommendation, the Final EIS no longer uses the term "upper bound."

48. To clarify a legal point TVA raises in the DEIS, the EPA does not agree that there is "legal uncertainty" regarding SC-GHG values. EO 13990 directed the IWG to publish the interim SC-GHG estimates for agencies to use "when monetizing the value of changes in GHG emissions resulting from regulations and other relevant agency actions until final values are published." While the interim estimates proposed by the IWG have been the subject of litigation, there are currently no legal constraints on the use of these estimates, which were developed under a robust and transparent process, represent the best available science and economics, and provide essential impact information to the public and decisionmakers. (Commentor: US Environmental Protection Agency*)*

Response: Comment noted. The "legal uncertainty" refers to the fact that the use of SCC by federal agencies has been the subject of litigation and inconsistent rulings. Nonetheless, TVA has used the SC-GHG estimates published by the IWG in its analysis, together with other SCC metrics used previously under the Trump Administration to provide a range of potential impacts. Monetizing social costs of GHG is not an exact science and presenting the social costs as a range of values provides decisionmakers and the public with better information for making an informed decision.

49. The EPA also recommends against applying the SC-GHG estimates developed under EO 13783 (revoked), because the full impact of GHG emissions is not reflected in multiple ways. First, those estimates fail to capture many climate impacts that can affect the welfare of U.S. citizens and residents. Examples of affected interests include direct effects on U.S. citizens and assets located abroad, international trade, tourism, and spillover pathways such as economic and political destabilization and global migration that can lead to adverse impacts on U.S. national security, public health, and humanitarian concerns. Assessing the benefits of U.S. GHG mitigation should also incorporate how those actions may affect mitigation activities by other countries, as those international actions will benefit U.S. citizens and residents. Scientific and economic experts have emphasized reciprocity as support for considering global damages of GHG emissions. Using a global estimate of damages in U.S. analyses allows the U.S. to continue to actively encourage other nations, including emerging major economies, to take significant steps to reduce emissions. (Commentor: US Environmental Protection Agency)

Response: Comment noted. See the response to *Comment No. 48.* Section 3.7.2 of the Final EIS includes SC-GHG estimates based on the current IWG guidance, which includes the broader global range of climate impacts, as well as estimates based on the now-rescinded Trump Administration guidance to offer a range of potential impacts for the GHG analysis. Presenting the social costs as a range of values provides decisionmakers and the public with better information for making an informed decision. The primary analysis of the climate impacts is provided by the proxy emissions analysis in the EIS, with the SCC analysis added to further inform the climate analysis.

50. The SC-GHG estimates based on a 7% discount rate (to approximate the social rate of return on capital) inappropriately underestimate the impacts of climate change when discounting the future benefits of reducing GHG emissions. Consistent with the findings of the National Academies, the economic literature and the IWG, the EPA agrees with the assessment that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context, and that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates. Furthermore, the impacts of climate change are measured in consumption-equivalent terms in the models used to estimate SC-GHG, so it is appropriate to use the consumption discount rate to calculate the SC-GHG. (Commentor: US Environmental Protection Agency).

Response: TVA currently utilizes a 7% discount rate when performing financial analysis that requires discounting to get the present value of future cost streams. It would be inconsistent for TVA to apply a unique or different discount rate to compare the alternatives on a net present value (NPV) basis in this case. Note, however, that the future costs of GHG emissions and the future project costs are different cost streams. For the future social costs of GHG emissions, the analysis uses values derived when applying a 3% discount rate, providing a range of costs assessed under the Biden and Trump Administrations.

51. Following best practice with benefit cost analysis, the EPA recommends discounting nominal values using nominal discount rates. The EPA recommends that the nominal discount rate should be the real discount rate plus the inflation rate. Alternatively, the values in these tables could be presented as real values (using the same base year dollars, unadjusted for inflation) rather than nominal values. Undiscounted sums (Table 3.7-3) should also be avoided. The EPA recommends using internally consistent discount rates for SC-GHG and Net Present Value (NPV) calculations. In particular, DEIS Table 3.7-3 (p. 191) uses a 7% discount rate for NPV calculations, while the SC-GHGs were calculated using a 3% discount rate. The EPA recommends that the TVA clarify the characterization that the SC-GHG "does not measure the actual incremental effects of an individual project." TVA states: "The SCC metric does not measure the actual incremental effects of an individual project due to both scale and complexity." (p. 186). GHGs are globally mixed, so the SC-GHG is well suited to measure the effect of individual projects. The SC-GHG is an estimate of the marginal social cost of emissions, which is the correct estimate to be applied to the scenarios considered in this DEIS. (Commentor: US Environmental Protection Agency).

Response: Global and regional climate models have substantial variation in output, and do not have the ability to accurately measure or predict the actual incremental effects from a specific project's GHG emissions on the environment. Therefore, the EIS uses the proxy method of GHG emissions analyses to assess climate effects by calculating net change in GHG emissions for each alternative as a percent of state, United States, and global emissions. The comparison allows TVA to contextualize the project's projected emissions. Notwithstanding the legal uncertainty and controversy surrounding the use of SC-GHG estimates, TVA prepared a supplemental analysis using SC-GHG to provide some perspective on the range of these social costs for the alternatives in relation to each other. See response to *Comment No. 50* (Discount Rates).

52. The EPA recommends revising the definition of the SC-GHG to clarify that the SC-GHG collectively refers to the SC-CO2 and other GHGs (including, for example, the social cost of methane (SC-CH4) and social cost of nitrous oxide (SC-N2O)). The EPA also recommends the FEIS use "SC-GHG" and "SC-CO2" as appropriate rather than "SCC." The definition should also clarify that in practice what is reflected in SC-GHG estimates is limited by data and available modeling methods. We recommend the following revision: "The SC-GHG is the monetary value of the net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year. In principle, it includes the value of all climate change impacts (both negative and positive), including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk and natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. In practice, estimates of the SC-GHG are unable to include all of the important physical, ecological, and economic impacts of climate change due to data and modeling limitations." (Commentor: US Environmental Protection Agency)

Response: Consistent with EPA's recommendation, the Final EIS has been revised to use SC-CO_2, SC-N_2O, and SC-CH_4 and the sums of the social costs of these three GHGs are presented as the SC-GHG (See Tables 3.7-6—3.7-15). TVA acknowledges that GHG includes pollutants other than CO_2 (See Section 3.7). The LCA analyses included in the Final EIS provide comparisons of CO_2, N_2O, and CH_4 emissions under each alternative.

53. The EPA recommends a consistent use of both the terms "social cost" and "social benefits." For projects that decrease emissions, the decrease multiplied by the SC-GHG can be either labeled as a negative cost or a positive benefit. The term "social cost benefit" is confusing and unclear. It may be confused with the term "social cost-benefit" or "social cost and benefit," which both refer to a complete assessment of the costs and benefits. For example, DEIS Table 3.7-6 is labeled "Social Cost Benefit of GHG Operational Emissions Reductions." However, this table is only presenting the social benefits (or negative costs). Furthermore, this table labels columns as the "Net SCC Benefit" and list benefits (or negative costs) as a negative value. The term "Social Cost of Carbon (SCC) Benefits" is unclear as to its meaning. (Commentor: US Environmental Protection Agency)

Response: Consistent with EPA's recommendation, these terms have been revised in Section 3.7 of the Final EIS.

54. The EPA recommends the SC-GHG be applied to the incremental emissions from the proposed Alternatives, as opposed to TVA-wide emissions. For example, to describe the emission benefits of Alternative C, the SC-GHG may be applied to the difference in emissions between Alternatives A and C. Alternatively, TVA could choose some plausible reference case for the system-wide modeling (e.g., a preferred scenario TVA uses in its IRPs and other long-term planning). TVA could then apply the SC-GHG to the incremental emissions from each Alternative relative to the reference case emissions. Applying the SC-GHG to total TVA-wide emissions under each Alternative obscures the relative impacts of the Alternatives. On a percentage basis, the differences in TVA-wide emissions may be relatively small across Alternatives, which can suggest the problematic conclusion that emissions across Alternatives are "similar." Although the DEIS only includes a time path for carbon emissions, we were able to apply the SC-GHGs to the carbon emissions in Table 3.7-3.

Our estimates show that the difference between the monetized value of carbon between Alternative A and Alternative C is $1.1 billion dollars (in net present value out to 2041), when using the SC-GHG value in 2021 real dollars). That does not include the monetized impacts of methane or N_2O, which will drive that value larger. Furthermore, while the DEIS does not specify the size of the pipeline for Alternative A or its volume per day, Page 19 of the document states "Preliminary estimates indicate that approximately 250,000,000 standard cubic feet per day of natural gas would be required for the CC plant." Based on estimates from EPA's Inventory of US GHG Emissions and Sinks, that natural gas will yield total upstream emissions of approximately 487,601 metric tons of CO_2, 11,518 metric tons of CH_4, and 1.1 tons of N_2O. Using a 3% rate for the SC-GHG, that yields an additional $817 million dollars in net present value (2021 dollars). (Commentor: US Environmental Protection Agency)

Response: TVA has included GHG life cycle analyses (LCAs) in the Final EIS that include social costs of CO_2, methane, and N_2O. One of the LCAs includes life cycle upstream emissions of methane from both the construction and operation of the natural gas pipeline.

A TVA system-wide comparison of emissions is the most effective way to accurately identify incremental emission differences between the alternatives. The replacement generation assets proposed in each of the action alternatives serve fundamentally different roles in the context of the larger TVA system in cost-effectively meeting electric load requirements. The combined cycle plant proposed in Alternative A would become one of the most, if not the most, fuel-efficient CC plants in the TVA system and as such is likely to be dispatched frequently in baseload or intermediate operations to reduce total system costs for TVA ratepayers. The CT plants in Alternative B would be some of the most efficient peaking units in the TVA system; however, they would almost always be dispatched after all available existing intermediate CC and coal units. CT units are typically used for more limited durations during periods of high electric load. Given these differences in operation, a straight comparison of CC plant and CT

plant emissions would erroneously lead to the conclusion that Alternative B leads to lower carbon emissions if consideration is not given to the fact that the proposed CC plant makes the overall TVA system more fuel-efficient. Similarly, the solar and storage proposed in Alternative C would generate and dispatch in yet another, completely different manner. The solar resources are intermittent in nature and only available during daylight hours. While the battery storage is fully dispatchable, it is energy-limited (i.e., only able to store up to four hours of energy at full output). TVA would seek to optimize the use of these solar and storage resources; however, the fact remains that there would be some hours of operation where neither of these resources is available and therefore TVA would be forced to rely on the existing fleet of coal and gas units to meet generation needs. Only a full system-wide comparison of the alternatives will accurately account for these differences.

The results of the system-wide life cycle analysis for each alternative are presented in Tables 3.7-12 and 3.7-13 in the Final EIS. Each action alternative is compared against the No Action Alternative in portraying the social cost of greenhouse gas emissions. The costs are presented utilizing both the Biden Administration 2020 SCC rate of $51 per metric ton at a 3 percent discount rate (addressing global effects) and the Trump Administration 2020 SCC rate of $7 per metric ton at a 3 percent discount rate (addressing domestic effects) to provide a range of potential impacts in light of the uncertainty that exists in these costs. Compared to the No Action Alternative, Alternative C generates the most cost savings followed by Alternative A, then Alternative B. On a NPV basis, presented in 2021 dollars, the analysis reflects about $4.8 billion of savings for Alternative C relative to the No Action Alternative. Alternative A reflects about $4.4 billion of savings relative to the No Action Alternative, and about $330 million less savings than Alternative C. Alternative B reflects about $3.9 billion of savings relative to the No Action Alternative, about $900 million and $590 million less savings than Alternative C and Alternative A, respectively.

55. Recommended revision to Table 3.7-2, Monitored Air Quality in Region of CUF:

- **The removal of data related to fine particulate matter less than 10 microns and sulfur dioxide (SO2) data, because the data was obtained from a nearby company and did not undergo formal data validation or certification.**
- **Data related to fine particulate matter less than 2.5 microns are available from a TDEC monitor close to Clarksville. TDEC suggests including this data in the final EIS.**
- **Additional data from Hopkinsville, KY is available and may also be useful**

(Commentor: Tennessee Department of Environment and Conservation)

Response: TVA has reviewed the referenced data and has updated the Section 3.7 of the Final EIS, as appropriate.

56. Tennessee has several air quality requirements that are more stringent than required by the federal Clean Air Act, which should be included in Table 1.5-1, which contains laws and executive orders relevant to the proposed action (Commentor: Tennessee Department of Environment and Conservation).

Response: The Final EIS has been updated to include applicable state statutes and Tennessee Department of Environment and Conservation regulations that would apply to the proposed action.

57. Comment expressing appreciation for TVA's commitment to seeking alternatives to open burning of material generated by site clearing activities, and the use of water to minimize dust. Recommends avoiding open burning on air quality alert days, and all construction equipment and heavy-duty non-road mobile sources be kept to a minimum. Requests these considerations be included in the DEIS. (Commentor: Tennessee Department of Environment and Conservation)

***Response*:** Comment noted. TVA plans on implementing best management practices (BMP) to limit open burning of material generated by site clearing activities and the use of water to minimize dust, as described in Section 2.3 of the Final EIS. As a best practice, TVA would seek to sell any marketable timber generated from onsite clearing activities. Non-marketable timber may be cut and left in place in specified, non-wetland areas as a windrow BMP or may be chipped and used as sediment barriers or mulch. Burning of clearing debris would be subject to local and state burn regulations and permits and would be scheduled to avoid air quality alert days. All operations would be conducted in a manner that prevents nuisance conditions or damage to adjacent land, crops, dwellings, roads, or people. If weather conditions such as wind speed or wind direction change rapidly during a burn operation, the operation would be suspended until weather conditions improve. Residue from burning will be disposed of according to permit requirements and applicable laws. Oil or refuse, including trash, rags, tires, plastics, and other manufactured debris, would not be burned anywhere on the job site. As a BMP, as well as fuel conservation consideration, idling of construction equipment and heavy-duty non road mobile sources will be minimized. The referenced BMPs will be implemented during site clearing activities and are described in the Final EIS.

IRP Modeling Process and Assumptions

58. The EPA therefore recommends TVA be fully transparent with respect to any modeling of alternatives it conducts. For example, if TVA conducted modeling to evaluate reliability, costs, environmental performance, etc., it should make public its modeling assumptions (e.g., price of natural gas, cost of battery storage) and the results of all model runs. The modeling should incorporate dynamic market trends and risks (e.g., climate transition risks), as well as examine appropriate policy-driven scenarios. (Commentors: US Environmental Protection Agency, Southern Environmental Law Center)

***Response*:** TVA's 2019 IRP, which is a long-term plan that provides direction on how TVA can best meet future demand for power, serves as the foundation for the development of TVA's system-wide least-cost plan and asset strategy consistent with TVA's obligations under the TVA Act. The IRP uses an integrated, least-cost framework that considered multiple views of the future to determine how potential power-generation resource portfolios could perform in different market conditions. The goal of the IRP is to identify an optimal energy resource plan that performs well under a variety of future conditions, taking into account cost, risk, environmental stewardship, operational flexibility, and economics.

The IRP's robust model-based analysis includes six scenarios (plausible future worlds that TVA could find itself in) and five strategies (ways in which TVA could react in each future) which are all evaluated in combination to form 30 core cases. Additionally, the 2019 IRP included around 10 sensitivity cases to further evaluate the impacts of changes in key assumptions with high stakeholder interest and to inform the target power supply mix recommendation. Included in the scenario analysis, the IRP studies a wide range of key uncertainties, including changes in electric load, natural gas prices, solar and storage prices, etc. Forecasts for these key uncertainties are informed by the narrative associated with the scenario (e.g., the Decarbonization scenario assumes regulatory-driven actions to curb GHG emissions).

The 2019 IRP included a "Variation in Climate" sensitivity, which provided TVA insights on how the effects of climate change in the Tennessee Valley might impact its system planning. Finally, the 2019 IRP evaluated policy driven scenarios and their impacts, most notably in the Decarbonization scenario and the "More Stringent Carbon Constraints" sensitivity.

For further information, please see the following sections from the 2019 IRP:

- Section 6.1 "Development of Scenarios": This section includes the logic and narratives that serve as the basis for each scenario. Also included are the ranges of electric load (Figure 6-2), fuel prices (Figures 6-03 and 6-4), market power (Figure 6-5), and carbon prices (Figure 6-6).
- Section 6.2 "Development of Strategies": This section includes logic and narratives that serve as the basis for what is promoted (i.e., received a modeling incentive that improved economics for adoption or selection) in each strategy. Figure 6-7 provides a "Strategy Design Matrix", which shows which cases included incentives for various resources, including solar and storage.
- Section 8.2 "Sensitivity Analysis"
- Appendix C, Figure C-7: "Distributed Solar and Storage Price Forecast"

The Cumberland EIS draws upon and tiers from the EIS that was completed for the 2019 IRP. The action alternatives considered in the Cumberland EIS are evaluated in the context of the target power supply mix, under TVA's least-cost mandate, and included in TVA's Asset Strategy, drawing upon the 2019 IRP modeling. For the purposes of ongoing internal planning and performing special studies, such as the Cumberland EIS, TVA reviews and updates many of the key assumptions included in the IRP bi-annually. While key modeling assumptions have evolved in comparison to the Current Outlook in the 2019 IRP, all forecasts of major uncertainties, including electric load, natural gas price forecast, and cost of battery storage, are still within the bounds studied in the 2019 IRP. Updated modeling assumptions are addressed in the Final EIS Sections 2.1.5.2 and 3.7.2.1.

Climate Change and Climate Impacts

59. For Alternatives A & B - The DEIS disclosed the GHG emissions associated with the operation of the CC/CTs but did not include a full life-cycle assessment of natural gas use. Upstream natural gas well drilling, production and midstream transport also emits significant qualities of CO2-e emissions. According to the EPA, oil and gas systems are one of the largest contributors to methane emissions in the United States. A 2019 Department of Energy report, Life Cycle Analysis of Natural Gas Extraction and Power Generation, considered the upstream CO2-e emissions of natural gas development in gas-fired power production systems. This report notes: When expanding system

boundaries to include the generation and delivery of electricity delivered to consumers, upstream natural gas accounts for 26% to 27% of life cycle GHG emissions for power systems without carbon capture systems (using 100-year GWPs). These GHG impacts were not captured and disclosed in the DEIS. The NPS recommends this information be included in the EIS and considered in the decision-making process. Also, please see the discussion of methane leakage rates. (Commentor: National Park Service, Southern Environmental Law Center)

Response: Comment noted. Section 3.7.2 of the Final EIS has been revised to include a life cycle analysis of upstream, as well as downstream, GHG emissions. The LCAs include social costs of CO_2, methane, and N_2O. One of the LCAs includes life cycle upstream emissions of methane from both the construction and operation of the natural gas pipeline.

60. DEIS states: "Stewart County is at least 140 kilometers from a federal Class I protected area or national forest. The expected combined emissions of SO_2, NO_x, and PM_{10} from the proposed CC plant in conjunction with this distance would result in visibility effects that do not exceed the regional haze screening criteria. Therefore, no regional haze requirements or PSD Class I effects analyses would apply under the permitting for construction of the new CC plant (AQ TVA 2021d)." Visibility-impairing pollutants from a CC would be significantly less than those from the coal-fired units. However, as part of the regional haze planning process, the NPS considered and evaluated much lower visibility impairment surrogate metrics to identify sources to evaluate in the control technology analyses. Addressing "smaller" emission sources in the future will be necessary to ensure ongoing progress toward the ultimate visibility goal. This underscores the need to ensure the most stringent emission limitations possible if the CC option is pursued. (Commentors: Southern Environmental Law Center)

Response: Emissions of pollutants implicated in visibility impacts (SO2, NOx, and PM) from the CC plant would be significantly lower than the CUF coal units that would be retired and whose generation would be partly replaced by the CC plant. The potential future impacts of the CC plant on visibility would be subject to regulatory review when Tennessee submits its State Implementation Plan for the third decennial period (2028 to 2038). TVA notes that emissions of SO2 and PM are very low when burning natural gas because of the nature of the fuel, and emissions of NOx from a CC plant under Alternative A would be controlled through use of state-of-the-art NOx controls such as low NOx burners and SCRs.

61 TVA's analysis of alternatives fails to consider carbon-free options, obscures the difference in greenhouse gas emissions between its alternatives, overstates the amount of solar and storage facilities needed to serve TVA's generation needs, and misstates the costs of the options the agency is considering. (Commentor: Southern Environmental Law Center)

***Response*:** The EIS evaluates Alternative C, which exclusively utilizes carbon-free solar as well as storage resources, in detail. TVA also considered other resources and blended alternatives that were not carried forward for more detailed review because they do not meet the project purpose and need. See EIS Section 2.1.6 and Response to Comment *1*. TVA is balancing the pace of its clean energy transition with its statutory obligation to provide low-cost, reliable, and resilient power. See response to *Comments No.1 and 22* for more information. Regarding the

differences in greenhouse gas emissions between alternatives, see response to *Comment No.* 54.

TVA performed a reliability analysis to determine an appropriate combination of solar and storage resources to maintain year-round system reliability. See Section 2.1.5.2.1 of the Final EIS. Resource option costs for gas units are from vendors and renewable and storage costs are informed by recent transactions and NREL forecasts. An independent review of TVA's cost analysis was performed by Concentric, which confirmed the reasonableness of TVA's estimates and assumptions. See Concentric Report at 8-15 (Appendix Q of the Final EIS).

62. TVA must apply the Social Cost of Carbon in compliance with Executive Order 13990 and guidance from the Interagency Working Group on Greenhouse Gases. The Interagency Working Group has also published values for the Social Cost of Methane and the Social Cost of Nitrous Oxide, both consistent with the methodology underlying the Social Cost of Carbon. While TVA applies the Social Cost of Carbon, it notes several baseless objections to doing so. The DEIS suggests there is widespread debate over the "economic discount rate" and whether "global effects, as opposed to only domestic, should be included." There is broad consensus on a discount rate of 3% or less and that global effects must be included. TVA also objects that the Social Cost of Carbon "does not measure the actual incremental effects of an individual project" and that "[t]here are no established criteria identifying the monetized SCC values considered significant for NEPA purposes." Those excuses are meritless.

TVA has no legal basis to apply outdated values for the Social Cost of Carbon. TVA appears to reference a district court's baseless nationwide injunction, swiftly overturned by the Fifth Circuit Court of Appeals. The Supreme Court rejected pleas to intervene made by opponents of the SCC. The result is that the Social Cost of Carbon, as determined by the Interagency Working Group, is the law of the land. TVA's Social Cost of Greenhouse Gases analysis violates Executive Order 13990. (Commentor: Southern Environmental Law Center)

Response: Despite legal and other uncertainties surrounding the use of SCC, TVA followed the guidelines in EO 13990 by conducting a GHG social cost analysis using values in the 2021 IWG guidance. TVA used a range of SCC values to reflect different economic discount rates as well as different perspectives on whether the effects analysis should cover global effect or be limited to domestic effects. The SCC values used by TVA encompass a range of effects and discount rates. Two differing cost evaluations were provided in TVA's analysis: one using carbon cost estimates from the Interagency Working Group (IWG) guidance using a 3 percent discount rate and another using SCC estimates reflective of a 7 percent discount rate. Providing a range in the EIS assessment better informs the public on the climate analysis as well as provides the decision-maker broader context to make a sound decision.

TVA disagrees with the commenter's characterization of the Fifth Circuit's decision in *Louisiana v. Biden*. As TVA understands it, the Fifth Circuit did not overturn the nationwide injunction in *Louisiana v. Biden*. It stayed the injunction pending appeal, and the U.S. Supreme Court declined to vacate the stay. The Fifth Circuit recently remanded the injunction to the district court on vagueness grounds, and the district court subsequently issued a new injunction limited to the plaintiff States. Therefore, the case is still in active litigation, and subject to further appeal.

In any event, the Final EIS Section 3.7 includes a robust GHG social cost analysis consistent with current guidance.

See responses to *Comments No. 48, 50*, and *51* for additional information.

63. Given the climate emergency, and the present and threatened impacts of climate change on the people TVA is mandated to serve, TVA's plan to replace the Cumberland Plant with a new fossil fuel plant is in flat violation of the TVA Act. Indeed, under TVA's current Integrated Resource Plan ("IRP"), the agency will not achieve decarbonization until sometime after 2100. Moreover, with increased reliance on gas as a replacement for coal, TVA is currently planning that it will generate more than 34 million tons of CO_2 each year in 2038. The utility already has the second highest planned gas buildout for this decade – 4 GW by 2030. This approach to decarbonization is completely unacceptable and will only further harm communities of color and other frontline communities who have been disproportionately burdened by TVA's reliance on fossil fuels and false energy solutions like fossil gas. Like coal, fossil gas disproportionately harms low-income communities and people of color. In addition to driving the climate crisis via especially potent methane emissions, gas generation produces over 60 hazardous air pollutants – including volatile organic compounds, carcinogens, and endocrine disrupting chemicals. And gas generation exposes communities within closer proximity to gas facilities to elevated ozone levels which, among other harms, can exacerbate asthma and other diseases. To be sure, earlier this year TVA proposed a non-binding plan to decarbonize TVA by 2050. This empty promise is meaningless on its own, but also only further demonstrates that, at bare minimum, it makes no sense to build new fossil fuel resources in the middle of the climate emergency.

Accordingly, to address the climate crisis and comply with the TVA Act, it is critical that TVA rapidly transition away from fossil fuels, including both its remaining coal plants as well as its fossil gas resources, and that the agency not build any new fossil energy generation to replace the retirements of existing fossil resources. (Commentors: Center for Biological Diversity, Southern Alliance for Clean Energy, Sierra Club, Citizens Climate Lobby)

Response: TVA's gas buildout is consistent with the 2019 IRP planning direction to retire coal capacity. The types of generation needed to replace the retired coal capacity is also guided by the 2019 IRP, which contemplates the addition of up to 5700 MW of CC capacity, up to 5300 MW of CT capacity, and up to 8000 MW of solar capacity, by 2028. The target supply mix adopted by the TVA Board in 2019 is consistent with least-cost planning obligations in 16 U.S.C. Section 831m-1 and aligns with the requirement in Section 15d(f) of the TVA Act to sell power "at rates as low as feasible." All of these considerations have informed the alternatives in the Final EIS and are expected to meet the intentions reflected in the Strategic Intent and Guiding Principles (May 2021) document, including a plan to reduce carbon emissions by 70 percent and a path to ~80 percent by 2030 and 2035, respectively, and to attain the aspiration of net-zero by 2050. While all action alternatives are consistent with TVA's aspirations to further decarbonize its resource portfolio, Alternative A best meets the stated purpose and is the lowest-cost solution.

TVA's proposed retirement of the Cumberland units is consistent with the 2019 IRP direction. Frequent cycling of the large super-critical units, which has become necessary as a result of the evolution of TVA's generating fleet (primarily driven by additions of nuclear, gas, and renewable resources over the past 10-to-15 years), is a recent change in the method of plant operation for which the plant was not originally designed. Frequent cycling presents reliability challenges that are difficult to anticipate and expensive to mitigate. It has also led to performance challenges that have caused deterioration of material condition of the units. The performance challenges are projected to increase because of the units' advancing age, leading TVA to conclude in the Aging Coal Fleet Evaluation that the first and second Cumberland units must be retired by 2026 and 2028, respectively. Replacement of the retired generation with 1450MW of CC natural gas generation provides firm dispatchable power that not only enables the retirement of the coal units but also helps integrate larger amounts of renewable energy to meet TVA's plan to install 10,000MW of solar by 2035.

See response to *Comment No. 38* (Carbon Trajectory and Compliance with Statutory Obligations). See also the Purpose and Need section of Final EIS Chapter 1.

Air Quality and GHG Emission Mitigation

64. The U.S. Department of the Interior (DOI) commented that the agency is supportive of the retirement of the Cumberland Fossil Plant, due to coal-fired generating units being a significant source of air pollutant emissions that impact units of the National Park System. Three parks are designated as Class I areas under the Clean Air Act (CAA). The DOI:

- **Urges TVA to reconsider the timeframe of retirement discussed in the DEIS to ensure the shutdowns occur within the region haze planning period established by the CAA.**
- **Encourages TVA to increase the renewable component of the generation fleet mix to the maximum extent feasible and use this as a factor in selecting power generation replacement options.**
- **Acknowledges that the Johnsonville Combustion Turbine Plant (JCT) Reservation under Alternative B is adjacent to the Water Route for the Trail of Tears National Historic Trail based on site-specific information contained within the DEIS**
- **Advocates that the focus of feedback on the proposed alternatives should be:**
    - **The emissions trade-offs between the various alternatives should be considered in decision-making.**
    - **The proposed control technology for criteria air pollutants for alternatives that involve fossil fuel-fired electric generation.**
    - **The potential direct and indirect emissions of greenhouse gases and criteria air pollutants under the various alternatives.**
    - **Additional analysis and information needs.**

(Commentor: US Department of Interior-National Park Service)

Response: See responses to *Comments No. 42* (Asset Strategy, including planned 10 GW of solar by 2035)and *Comment No. 65* (Mitigation Measures). See also Section 3.7.2 and associated appendices in the Final EIS.

The Final EIS includes a robust analysis of the potential direct and indirect emissions of GHGs for the alternatives, which is also addressed in response to *Comment No. 18* above. See also the Final Cumberland Alternatives Analysis (Appendix B of the Final EIS). Emissions of greenhouse gases as well as criteria pollutants have been considered in the EIS analysis and in the identification of Alternative A as TVA's preferred alternative. Additionally, if Alternative B (Johnsonville is one of the sites considered under Alternative B) were selected, additional site-specific tiered NEPA analyses would need to be completed as site-specific design details become available; and the appropriate coordination and consultation would be conducted regarding any potential impacts to the Water Route for the Trail of Tears Historic Trail.

65. The EPA recommends that TVA consider the infrastructure and siting needs related to the need for future potential carbon mitigation measures at combustion turbines. TVA should also provide the total costs for these mitigation measures so that risks of financial impact are fully understood. TVA should assess: 1) space to locate carbon capture equipment or electrolyzers for clean hydrogen production; 2) pipeline routes and storage sites for potential CO_2 sequestration; and 3) any pipeline and/or storage needs associated with clean hydrogen. (Commentor: US Environmental Protection Agency)

Response: See response to *Comment No. 33* regarding mitigation measures.

The design of the proposed Alternative A CC plant will enable future modifications for carbon capture and hydrogen use as those technologies mature. The proposed CC would be designed to be 5 percent hydrogen capable at commissioning by adding balance of plant equipment that includes space for future hydrogen storage, appropriately sized piping, and a blending station. TVA would also purchase a combustion turbine capable of burning at least 30 percent hydrogen, by volume, with modifications to the balance of plant once a hydrogen source is available. Additional equipment could be located on the former coal plant site after those areas are closed and remediated. While it would be premature to evaluate the costs of these options, TVA anticipates the efficiency and effectiveness of these systems to improve in the next several years and will allow for better decisions when adequate storge locations or pipelines are identified for the disposal of captured CO_2.

In a separate effort TVA is planning to explore deep geology at or near multiple TVA locations, including Cumberland, for suitability/capability of carbon storage. If these efforts do not yield acceptable storage reservoirs locally, then onsite use of CO_2 as a feedstock for a utilization process or transportation would be required. Currently, no utilization of CO_2 at an appropriate scale is available to be evaluated for this project. CO_2 pipeline routes have not been identified at this time; however, the most promising geological storage location would appear to be in the Coastal Plains to the south based on a national assessment of geologic storage by the USGS. These and other practicable mitigation measures are addressed in Final EIS Section 2.3.

TVA cannot analyze pipeline routes, costs, storage requirements, or other needs with hydrogen gas incorporation until a viable source has been identified.

66. The FEIS should include a more detailed explanation of why options that included carbon mitigation were not more fully considered. Although TVA suggests it is considering transitioning the turbines built in Alternatives A or B to lower GHG emitting technologies, e.g., hydrogen or carbon capture and storage (CCS), TVA neither commits to them, nor analyzes the potential resulting emissions reductions. For instance, in its

site selection criteria, the DEIS does not consider access to clean hydrogen and or sequestration sites, nor sufficient room to add post combustion CCS or clean hydrogen. Further, the DEIS seems to have rejected considering those options in the short term. Given the trends noted above, the EIS should explain its choice not to consider them. The EPA recommends that TVA discuss its evaluation of these types of technologies as mitigation options, and whether TVA has any short or long-term plans to ensure there is a plan for reducing GHG emissions from new fossil assets like the turbines in alternatives A and B. (Commentor: US Environmental Protection Agency)

Response: See responses to *Comments No.1, ,* which addresses TVA's evaluation of reasonable alternatives, and responses to Comments No. *33*, and *65,* which address the Final EIS's evaluation of CCS and hydrogen. The Final EIS Section 2.3.2 evaluates CCS and hydrogen as potential mitigation. The Alternative A CC plant would be designed to utilize a 5% hydrogen blended fuel, and the Cumberland site, following demolition of the coal units, would have adequate space for additional hydrogen-related equipment.

Carbon capture technology has not yet been demonstrated for full scale systems in operation on CC plants. There are currently several projects and efforts underway to advance this technology (e.g., DE-FOA-2515: Carbon Capture Research and Development for NG and Industrial Point Sources, and FEED Studies for Carbon Capture Systems at Industrial Facilities and NG Plants). TVA anticipates the efficiency and effectiveness of carbon capture systems to improve in the next several years and will allow for better decisions when the technology proves viable at scale and adequate storge locations or pipelines are identified for the disposal of captured CO_2. Once TVA can identify storage locations that are adequate, a state-of-the-art carbon capture technology can be evaluated consistent with future regulations for GHG reductions. Alternative fuels are evaluated in the Final EIS Section 2.1.6.

67. TVA fails to consider greenhouse gas mitigation. Here, TVA violates NEPA by failing to include meaningful—indeed any— consideration of GHG mitigation in its DEIS. Because TVA provides no plan to mitigate the decades of greenhouse gas emissions it proposes, the DEIS violates NEPA and federal climate policy (Commentor: Southern Environmental Law Center).

Response: While TVA's obligations under NEPA require the consideration of mitigation measures, they do not require the adoption of mitigation measures that fully compensate for the environmental impacts of a proposed action. Nonetheless, TVA has provided an evaluation of carbon mitigation measures in Section 2.3.2 of the Final EIS.

See also responses to *Comments No. 33, 65*, and 24 regarding mitigation measures and response to *Comment No. 38* regarding consistency with federal climate policy.

ENVIRONMENTAL JUSTICE

68. TVA evaluated demographic data of the population near the CUF reservation, along the proposed pipeline corridor, and contiguous counties. Four census block groups were found to have significant populations of residents living in poverty. Generally, the DEIS discussions of environmental justice impacts appear to assume that various environmental impacts are not anticipated to be disproportionate on the identified environmental justice populations because similar effects would occur to other populations in the area. Although similar impacts may occur in the general population,

these effects may be amplified in some communities with environmental justice concerns due to health, socioeconomic, or cultural vulnerabilities. CEQ's environmental justice guidance states that Agencies should recognize the interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed agency action. For example, if the residents living in poverty rely more heavily on fishing or hunting for subsistence, they will be more adversely affected by impacts to aquatic and wildlife resources. Similarly, temporary or permanent effects to prime farmland relied on by low-income farmers could potentially be more severe than to the general population. (Commentor: US Environmental Protection Agency)

Response: As presented in the Final EIS, for each identified EJ population, TVA further reviewed the analyses of those populations to gather and present more background on the socioeconomic, cultural, and health aspects of the populations. This included presenting additional socioeconomic aspects from USCB census data, background on the cultural history of the area, and environmental indicators of concern using USEPA EJScreen. In addition, other resource area spatial data was inputted into GIS, along with the EJ population data, to provide a more detailed spatial analysis to allow the analysts more context on how EJ populations may be impacted differently than other populations. Consistent with EPA's recommendations and relevant EJ guidance, these data were used to more effectively evaluate effects on EJ populations, especially regarding the potential for disproportionately high and adverse human health or environmental effects on identified minority populations and low-income populations. The Final EIS's EJ analysis indicates which effects may be amplified in EJ communities due to health, socioeconomic, or cultural vulnerabilities. *See Comment No. 75* and Final EIS Section 3.4.

69. The EIS should identify and disclose reasonably available information from affected communities and other appropriate sources about susceptibilities or vulnerabilities that could potentially amplify the environmental justice impacts discussed in the DEIS. This information should be taken into account in concluding that the proposed project's environmental impacts on environmental justice populations are the same as those on other populations in the area.

In discussing the impacts of the various alternatives on environmental justice communities, the Draft EIS simply assumes the impacts are the same with no analysis whatsoever. Indeed, the Draft EIS states that none of the alternatives – including simply keeping the Cumberland coal plant open – would have any adverse impacts on environmental justice communities. (Commentors: US Environmental Protection Agency, Center for Biological Diversity)

Response: See response to *Comment No. 68*.

70. TVA should also account for impacts resulting from the construction and operation of the natural gas pipeline that is required to operate the preferred alternative. The EPA notes that the pipeline contractor has begun coordination with landowners for the purchase of easements and coordination with local governments and federal agencies for required permits. Though there is a separate process for permitting pipelines

administered through FERC and a separate NEPA analysis is planned to specifically analyze the pipeline, any reasonably foreseeable disproportionate impacts to communities with environmental justice concerns should be identified and addressed, consistent with EO 12898. This would include not only potential air quality and other impacts on these communities, but also ensuring equitable use of eminent domain and consideration of possible pipeline failures. This analysis should also include consideration of the cumulative pollution and non-pollution burdens on the communities with environmental justice concerns, which can make those communities more susceptible or vulnerable to environmental impacts. (Commentor: US Environmental Protection Agency)

Response: The Final EIS evaluates potential EJ impacts resulting from the construction and operation of the natural gas pipeline. In the Final EIS Section 3.4, the EJ analyses were updated to incorporate the results from the revised Resource Reports submitted by TGP to FERC for the natural gas pipeline lateral, which included the results of the EJ analyses. TVA added several EJ census block groups to the Final EIS EJ analysis that were identified through the Resource Reports that were not identified in TVA's initial EJ analysis. Since the definitions of minority and low-income populations differed between the two analyses (TVA's analysis and the analysis in the Resource Reports), this led to slightly different results. Those additional census block groups within the CUF Reservation EJ study area, along with those that the TVA analyses identified, were factored into the Final EIS EJ analysis regarding the potential for disproportionately high or amplified and adverse human health or environmental effects on identified minority populations and low-income populations.

See also response to *Comment No. 68 and 75*.

71. The discussion of climate change and GHGs should acknowledge the disproportionate impact that GHG emissions have on already overburdened and vulnerable communities. See, e.g., Climate Change and Social Vulnerability in the United States, EPA (2021). Similarly, the alternatives discussion should recognize the differences in the GHG emission impacts of each alternative on those vulnerable communities. Also, the environmental justice analysis of non-GHG stressors should include ongoing and projected climate-related impacts, consistent with section 219 of EO 14008.

Executive Order 12898 is clear that one factor in determining whether a population faces disproportionate adverse impact is whether the impacts would occur in a community "affected by cumulative or multiple adverse exposures from environmental hazards." TVA must evaluate the environmental effects of its alternatives on each affected population, including an examination of existing pollution and health burdens, and not just assume that all populations react the same way to the same effects. (Commentors: US Environmental Protection Agency, Southern Environmental Law Center, Citizen's Climate Lobby, Clean Up TVA Coalition - See Table of Signatures in Section C of this Appendix)

Response: In the Final EIS, additional attention was given to climate change and other environmental factors, consistent with Section 219 of EO14008, in the expanded air quality and

greenhouse gases analyses. These were in turn factored into the EJ analyses, along with updates in Section 3.4 to acknowledge the impact that existing GHG emissions and other environmental factors have on EJ populations by utilizing the USEPA EJScreen database. The existing percentiles in EJ areas were used in the environmental consequences section to evaluate the potential for disproportionately high and adverse human health or environmental effects on identified minority populations and low-income populations in the Section 3.7 of the EIS.

72. TVA fails to meaningfully analyze the potential for disproportionate adverse impacts on environmental justice communities by using overly broad census data, relying on unjustified assumptions about geographic scale, and understating environmental harms throughout the DEIS, including cumulative harms. (Commentor: Southern Environmental Law Center)

Response: The Final EIS has been updated with a more detailed analysis per EPA comments including additional explanation of the study areas, more thorough cumulative impacts analysis, and updated assessment of environmental consequences for each resource topic, and includes consideration of the intersection of climate change and EJ impacts. As detailed in EIS Section 3.4, TVA identified EJ populations consistent with CEQ and EPA tools and guidance. Where populations were determined to meet the criteria regarding minority, low-income, and/or LEP status and, therefore, considered qualifying EJ populations, additional USCB data, USEPA data, historical information, and relevant details from other sources were obtained to better understand the socioeconomic and sociocultural aspects of these populations and more effectively evaluate for disproportionate environmental and human health effects on EJ populations. The additional USCB data obtained included other relevant demographic factors, as well as information regarding the rural or urban status of the area. USEPA's EJScreen tool was used to consider 12 different environmental indicators in EJ-qualifying areas in comparison with the state. Section 3.4 evaluates in detail the potential adverse effects to the identified EJ communities and address which effects may be amplified in EJ communities due to health, socioeconomic, or cultural vulnerabilities.

See also response to *Comment No. 68.*

73. **There was a matrix presented at the May 18, 2022 public open-house showing the impact of the various options on a number of parameters, including socioeconomic impact, which was listed as "minor". Houston county has historically been an economically depressed area, and both the TVA plant and associated Georgia Pacific facility represent a large portion of the good paying jobs in the area. Yes, the impact may be low from a national perspective, but it an insult to the community to assign this a "minor" impact. There needs to be a companion effort beyond the demolition of the plant to work with Houston and Stewart county to bring in more economic activity to compensate for the loss of the Cumberland City plant. (Commentor: Stephen Black)**

Response: Choosing to retire our coal assets is not an easy decision. Many of the drivers for retiring coal assets are external factors, including an evolving energy industry that is transitioning toward more renewables, flexible gas, and storage resources; costly, aging assets; customer demand for renewables; environmental regulations to reduce carbon footprint; and future power demand. Recommending a least-cost asset strategy with all of these priorities in mind ensures TVA continues to fulfill its mission to serve the people of the Tennessee Valley.

TVA acknowledges the comment and understands that the economic impact of the CUF plant is important to the surrounding community. See EIS Section 3.16 for a detailed discussion of the socioeconomic impacts of the various alternatives. Under TVA's Preferred Alternative, while CUF coal closures would decrease employment in the CUF labor market area for the long term, construction of the CC plant would temporarily increase employment in the area. Ongoing employment at the new CC plant, anticipated to permanently employ approximately 25 to 35 people would be new employment options in the CUF labor market area. In addition, TGP anticipates a workforce of 300 to 400 people (50% of which are likely to be local) during construction of the pipeline. These employment increases may temporarily help offset some employment losses associated with CUF coal facility retirement.

TVA remains committed to supporting economic development in areas where we retire generating assets. As we have done with other TVA sites impacted by fleet changes, we will evaluate options for the sites of retiring units. These options may include both replacement generation and opportunities for economic or other type of redevelopment.

74. TVA's method of determining the geographic scale of the affected environment has not been justified and could lead to overlooking potential environmental justice communities. A report on NEPA best practices from the Environmental Justice Interagency Working Groups notes that "[t]he geographic extent of the affected environment may vary for each resource topic analyzed in the NEPA document. As the D.C. Circuit has made clear, "[w]hen conducting an environmental justice analysis, an agency's delineation of the area potentially affected by the project must be 'reasonable and adequately explained,' [] and include 'a rational connection between the facts found and the decision made.'" TVA needs to justify the use of a 10-mile radius circle (or a 1-mile radius corridor for the pipeline route) for each relevant impact and perform its environmental justice analysis accordingly. (Commentor: Southern Environmental Law Center)

Response: The factors described in the comment were factors that were considered by TVA in defining the various EJ study areas presented in the Draft EIS. Further, Section 3.4 of the Final EIS was updated to provide more detail on the various study areas used for each alternative or alternative component.

The EJ study area identified and evaluated in the Draft and Final EISs vary by resource area. In particular, the 10-mile radius used for the CUF, Gleason, and Johnsonville Reservations was selected because it is the maximum distance of potential effect based on the resource areas assessed in the Final EIS. The 10-mile radius incorporates the farthest reaching resource areas evaluated, which were Transportation and Cumulative Impacts. This radius was used to query US Census Bureau data and compile a geodatabase of information that was used to identify EJ populations within a 10-mile radius of the project reservations.

The next step was to perform resource-specific impact assessments based on the anticipated area of effect for that resource. For example, the assessment for Natural Areas, Parks, and Recreation (Section 3.9) used a 1 mile radius as the reasonable area of potential effect. If potential effects to the Natural Areas, Parks, and Recreation resource area were identified, then further analysis was performed to determine the potential for amplified or disproportionate effects to any of the EJ populations identified within that 1-mile radius. Thus, the EJ impact

assessment for Natural Areas, Parks, and Recreation was also performed using a 1-mile radius. Similarly, potential Transportation effects were assessed using a 10-mile search radius, thus any identified effects were further evaluated for potential disproportionate or amplified effects to the EJ populations identified within the 10-mile search radius.

Likewise, a one-mile radius was used to evaluate potential EJ impacts of the proposed pipeline. A one-mile radius around the pipeline corridor encompasses the largest area of potential impact for any of the resource areas analyzed within the EIS and therefore provides an appropriate review of potentially affected EJ populations commensurate with effects associated with the pipeline. The 1-mile radius is sufficiently broad considering the likely concentration of construction emissions, noise, and traffic impacts proximal to the pipeline construction and consistent with FERC regulations (18 CFR § 380.12 Environmental reports for Natural Gas Act applications.) This radius factors in the area potentially affected in the unlikely event of pipeline failure. See Section 3.4. for additional information.

75. TVA must not rely on demographic information at the census block level to determine whether a particular geographic area contains potential environmental justice communities. Although TVA described reaching out to "local plant personnel and local government officials" to determine if the census data left out any environmental justice communities, this appears to have only been for the 10-mile area around the Reservations, not along the pipeline route. Additionally, local plant personnel and local government officials may not have all the relevant information about the local community; TVA could and should also request input from other sources, such as schools. (Commentor: Southern Environmental Law Center)

Response: TVA contacted local officials and leaders, schools, and community action organizations in and around the Cumberland Plant. TVA partnered with the Highland Rim Economic Corporation to identify potential EJ communities, as well as distributed information to these communities during their commodity distribution events. TVA also engaged with multiple schools local to the Cumberland plant. TVA provided a pizza party and distributed coloring books with project information/factsheets to the Stewart County Middle School and Tennessee Ridge Elementary School. TVA also used the data from the Draft EIS environmental justice analysis and its internal Customer Analytics group to specifically identify the home addresses of low income and minority individuals so that postcards could be directly sent to EJ households.

As discussed in Section 1.9 (Stakeholder Outreach) of Resource Report 1, General Project Description, TGP conducted a number of meetings with federal, state, county, and local elected officials in the Project area and the Chamber of Commerce for each county where the pipeline facilities are located as part of its general community outreach. Notices of open houses were mailed to affected landowners along the route of the proposed pipeline, as well as to elected officials. At these open houses, information about the pipeline was provided in written and visual formats. TGP is determining additional activities to address any concerns or issues raised by organizers and community leaders of the identified environmental justice communities, which may include additional meetings in these communities. In addition, as part of its ongoing efforts to identify and communicate with environmental justice communities that may be affected by the Project, TGP is evaluating the development of materials describing the Project, anticipated impacts, milestone schedule updates, and public participation opportunities to specifically address the needs and concerns of the identified environmental justice communities. TGP's communication and involvement with the environment justice communities is ongoing and will continue through the certificate, permitting, construction, and restoration phases of the pipeline.

76. TVA may not avoid analyzing impacts on environmental justice populations, including cumulative impacts, by characterizing impacts as minor, temporary, or likely to [be] avoided or mitigated. At times TVA claims that impacts will not be disproportionate without even making the most important comparisons. TVA assumes that environmental justice communities won't be disproportionately impacted by stream and wetland crossings related to Alternative A because such effects "would be similarly experienced" by both environmental justice communities and other population," but does not bother to actually quantify the number of stream and wetland crossings in the acknowledged environmental justice communities. (Commentor: Southern Environmental Law Center)

Response: The Final EIS has been updated in Section 3.4 and throughout the remainder of Chapter 3 to provide a more thorough characterization of the affected environment and potential resource-specific effects associated with the Project anticipated within the identified EJ communities, including identification of effects that may be amplified in EJ communities.

See also response to *Comment No. 68.*

77a. TVA should also analyze the environmental justice impacts of solar energy in its analysis of Alternative C. TVA notes that farmland may be converted in the siting of solar farms, but simply states, without explanation, that these are "not expected to have "disproportionate effects on EJ populations." The siting of solar projects may affect environmental justice populations in negative ways, such as farmland conversion, but also in positive ways, such as increased economic opportunities. (Commentor: Southern Environmental Law Center)

Response: The EIS has been updated to include more robust GIS-based analyses along with additional discussion of potential effects to EJ populations, including information such as farmland data, alongside more information clarifying the social/cultural understanding of EJ populations. EIS Section 3.4.2.5 evaluates the potential EJ effects for Alternative C, including potential economic impacts and impacts related to conversion of agricultural land. The EIS finds that, generally, such effects resulting from solar generation would be the same for EJ populations and other populations in the project area. The EIS acknowledges that potential impacts could be exacerbated for EJ populations in light of cumulative effects. See also response to *Comment No. 71.*

77b. TVA should commit to the NAACP's Equitable Solar Policy Principles to ensure that future solar energy development is inclusive of environmental justice communities." (Commentor: Southern Environmental Law Center)

Response: TVA acknowledges the importance of ensuring that future solar energy development is inclusive of EJ communities. Future solar energy projects will be subject to appropriate case-by-case environmental reviews. TVA considers impacts on EJ communities consistent with EO 12898 and other applicable requirements. These environmental reviews provide opportunities for the public and stakeholder groups to provide their views on TVA's assessment of EJ impacts.

78. The Draft EIS claims that none of the alternatives will have disproportionate impacts on environmental justice communities. Draft EIS at 45. This conclusion, however, ignores the particularly disproportionate impacts that fossil fuel plants and waste have on these communities. As a threshold matter, it is well-recognized that the fossil fuel economy

particularly harms Black, Indigenous, and other communities of color. Black Americans are exposed to 56% more polluted air than white Americans, on average, and more than one million Black Americans live within a half-mile of gas facilities, resulting in higher risks of cancer and other health problems.

The retirement of the Cumberland Plant also calls into question the treatment and disposal of coal ash. Fossil fuel waste, like coal ash, disproportionately harms environmental justice communities. The improper storage of coal ash leads to chemicals leaching into the environment, such as waterways, poisoning communities who reside near fossil fuel plants and coal ash dump sites. TVA has a history of coal ash mismanagement and improper disposal which has led to significant public health and safety hazards in communities of color and low wealth communities like Memphis and Kingston, Tennessee and Uniontown, Alabama. Moreover, environmental justice communities are disproportionately vulnerable to and suffer first and worst from the climate emergency. This disparate vulnerability is the product of structural racism and injustice. Centuries of discriminatory policies (particularly, around housing and economic development) have left U.S. communities of color — especially, Black, Hispanic, and Indigenous communities, who experience significantly higher poverty rates than their non-Hispanic white and Asian counterparts — at a severe disadvantage in being prepared for climate adaptation and mitigation. As more frequent and severe disasters driven by climate change compromise the physical integrity of those facilities and fossil fuel energy infrastructure more broadly, communities of color face the greatest risk. Already, past climate disasters including Hurricane Harvey have damaged highly contaminated Superfund sites, which can leak dangerous pollutants into surrounding communities and dramatically set back essential clean-up efforts. More recently, severe winter weather in Texas highlighted the risks of climate disasters to fossil fueled electric grids when it caused millions to lose power, hitting Black and Brown Texans particularly hard. The disproportionate impacts of such outages on communities of color and low-wealth communities is a clear form of energy violence, which can carry life-long consequences for those communities. Black households also pay significantly more than their White counterparts for energy, just as low-wealth households tend to spend more of their income on energy than their higher wealth counterparts. Climate-induced disasters risk trapping households in cycles of energy poverty, decreasing their ability to withstand and recover from the inevitable next storm, drought, or other extreme weather event. (Commentor: Center for Biological Diversity)

Response: Impact analyses and determination of proportionality have been further refined in the Final EIS, consistent with suggestions by EPA and other EJ commenters. The EIS recognizes the disproportionate effects that the fossil fuel economy and waste, such as coal ash, and climate change (especially in relation to discriminatory policies that have led to increased vulnerability), has on EJ populations. TVA also utilized the EnviroAtlas and EPA EJScreen Tool and other available resources/tools, to look at climate change effects (rising temp, etc.) near EJ populations to assess current vulnerability, potential for disproportionate or amplified effects, and to compare with effects from each of the alternatives. Section 3.4 of the Final EIS has been revised to reflect this additional analysis.

79. The DEIS ignores potential groundwater effects of pipeline construction and operation on drinking water, particularly for environmental justice communities. The DEIS's discussion of environmental justice considerations of the groundwater effects from implementation of Alternative A entirely ignores the effects on groundwater quantity and quality on environmental justice communities along the pipeline route, focusing instead on the "distance" of such communities "from the TVA-owned reservation." But, as discussed above, pipeline construction and operation can affect groundwater quality and quantity. And even TGP's Draft Resource Report 2 acknowledges that the Mississippian Aquifer underlying the pipeline corridor "is used as a source of drinking water for 35 municipal water systems in Tennessee and supplies a majority of the drinking water for rural domestic and non-community use throughout the Highland Rim (USGS 1986). (Commentor: Southern Environmental Law Center)

Response: The Final EIS has been updated to include a discussion of potential groundwater effects of pipeline construction and operation on drinking water, with additional discussion of EJ-specific effects. TVA's analysis incorporates additional information from the most recent TGP FERC Resource Reports. See Final EIS Section 3.6.1.1.2.1 and 3.6.1.2.3.2.

ENVIRONMENTAL EFFECTS AND AVOIDANCE

Environmental Effects

80. **TVA must also consider an alternative that includes advancing the timeline for Cumberland's complete retirement to earlier than 2033, which would significantly reduce TVA's GHG emissions. The Draft EIS also contains another fatal flaw: the failure to meaningfully consider the relative environmental impacts among the alternatives. This analysis is vital to comply with NEPA. See 40 C.F.R. § 1502.14 (explaining "[a]lternatives section should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public) (emphasis added); Sierra Club v. United States Forest Serv., 857 F. Supp. 2d 1167, 1177 (D. Utah 2012).**

Here, TVA has largely compared each of the alternatives to the no action alternative (i.e., keeping the Cumberland Plan open), and on that basis determined that each alternative would have beneficial impacts on the environment. Thus, for example, for air quality and GHG emissions, by only comparing each alternative to the no action alternative, TVA found "long-term beneficial effects." Indeed, TVA's entire discussion of the air quality and GHG impacts of Alternative A—building the new gas plant—simply compares that alternative to the Cumberland coal plant emissions.

Most importantly, TVA has not meaningfully compared the relative environmental impacts between expanding the agency's gas fleet as compared to transitioning to fossil-free alternatives. Indeed, the preferred alternative is to build a new gas plant in the footprint of the Cumberland Plant. Had TVA made the building of this new gas plant its

proposed action, the agency would have been forced to analyze the comparative environmental harms posed by the fossil fuel plant as compared to fossil-fuel free alternatives. This approach would have starkly shown that building one or more gas plants and associated pipelines will be significantly more harmful to the environment than other alternatives. Once again, TVA cannot avoid a meaningful NEPA analysis by playing games with the project under consideration, defining the project as whether to close the Cumberland Plant and then declaring that all the alternatives are environmentally beneficial because they are all less devastating to the environment than coal. Given that the purpose of the action is to close the coal plant, it simply makes no sense to frame the no action alternative as keeping the plant open. Rather, the focus of the EIS should be on the various alternatives TVA might adopt to replace the lost generation there. In short, TVA may not avoid disclosing and considering the relative environmental impacts of alternatives by simply comparing them all to a non-existent option of keeping the Cumberland plant operational into the indefinite future. (Commentor: Center for Biological Diversity)

Response: See responses to *Comments No. 1, 31,* and *32*. Further, TVA believes it is appropriate and meaningful to compare the impacts of the action alternatives with the No Action alternative of continuing to operate the CUF coal facility because those action alternatives would be undertaken only in conjunction with the retirement of the coal facility. This approach is consistent with CEQ's NEPA regulations at 40 CFR 1502.14.

Physical Resources

81. In the Draft EIS TVA notes that the pipeline corridor for the preferred alternative would pose moderate geological hazards as the pipeline would pass through sinkhole-prone limestone bedrock and karst topography. However, this terrain is susceptible to erosion which is a pre-cursor to sinkholes. With climate change, the Tennessee Valley is expected to see increased flooding and thereby more extreme erosion, posing a potentially higher risk of sinkholes. The Bluegrass NGL Pipeline in Kentucky is a case in point, as a combination of sinkholes in karst terrain and gas pipeline leaks resulted in explosions, posing alarming public safety and environmental concerns. However, thus far TVA's EIS for this new gas plant entirely ignores these serious environmental risks. Pipelines are subject to extraordinary stresses when crossing areas of karst potential, further exacerbated by increased erosion. Any leaks or ruptures in the pipeline can have immediate consequences even as far as tens of miles from the site. In the case of a leak, sinkholes can fill with fumes and gas which displace air; caves have become explosion hazards. Additionally, groundwater that encounters flammable vapors could result in fires and pose another explosion hazard for households that use well water. The Draft EIS notes that the gas CC plant and pipeline overlie the Mississippian carbonate aquifer system. The risk of pipeline explosions is a significant concern that TVA must fully address in the EIS, especially as an environmental impact in the agency's public safety analysis. (Commentor: Center for Biological Diversity)

Response: Geologic features, such as sinkholes or karst terrain, would be avoided during pipeline construction. TGP retained Geosyntec Consultants to complete a Phase I and II Geological and Hydrotechnical Hazard Assessment for the pipeline area, which included a

detailed desktop evaluation on landslides, ground subsidence, seismic hazards, sinkhole formation, and flood and scour potential. Ultimately, based on the results of the geophysical surveys and information collected during the prior assessments, significant subsurface karst features (e.g., voids) are not anticipated to be encountered during construction at the reviewed locations and site-specific mitigation plans through these areas are not considered necessary. "[A] Karst Hazards Mitigation Guidance Plan will be followed for construction through all karst areas identified along the route to address unexpected conditions that may be encountered in these or other areas and to avoid causing construction-related adverse impacts associated with constructing in karst prone areas." (TGP 2022f)

"[…] Ground subsidence could occur in areas where the potential for karst development has been identified. The structural integrity of a pipeline greatly reduces the probability that a sinkhole would impact the integrity of the pipeline. […] TGP will routinely monitor the geotechnical integrity of the [pipeline] sites as part of its current operations and maintenance activities for its pipeline system. Potential impacts to the geotechnical integrity of the [pipeline] from karst would be identified, and corrective actions immediately implemented, to ensure the safe operations of TGP's system. Localized settling or possible "cracking" of the soil in or near potential karst features would be observed and noted during inspections. These areas would be noted and inspected by TGP personnel. If required, maintenance work would be performed to correct the situation by re-grading, installing additional soil, or mitigating the sinkhole." (TGP 2022f).

Section 3.5.1 of the Final EIS has been updated with geology information for the proposed pipeline from TGP Resource Report 2 (Water Use and Quality) and Resource Report 6 (Geological Resources).

See also Appendices 6.C and 6.F of TGP's Resource Report 6 for evaluation of potential karst features and hazard mitigation.

82. The DEIS ignores the potential for interruption of groundwater flow from construction and operation of the pipeline. Stated otherwise, "[c]hanges in hyporheic flow patterns" are among the effects of pipeline construction. That is because trenching activities associated with pipeline construction increase the permeability of soil and rock alongside the pipeline, causing backfilled trenches to intercept groundwater flows into and then along them. As FERC has recognized, pipeline construction "[b]lasting has the potential to impact groundwater quality through a short-term increase in turbidity at nearby wells and/or springs. Additionally, blasting may impact groundwater quantity by altering the discharge to springs in blasting areas. Vibrations caused by blasting also have the potential to locally affect bedrock fractures within the bedrock aquifer, which could temporarily result in diminished well yields and increased turbidity.

The DEIS does not sufficiently evaluate the effects of construction in karst on groundwater. The DEIS does not evaluate the effects on groundwater of construction and operation of either the CC Plant or the Pipeline in karst terrain. The DEIS acknowledges the presence of karst terrain on the CUF Reservation. The DEIS further recognizes that "[k]arst terrain could affect portions of the pipeline[.]" TGP acknowledges that further assessment of karst in the Pipeline corridor and "potential impacts to groundwater resources" is necessary. (Commentor: Southern Environmental Law Center)

Response: See TGP Resource Reports 2 and 6 (controlled blasting impacts), specifically Appendices 6.A and 6.B for evaluation of potential karst features and mitigation. This information has also been included in Sections 3.6.1.1.2.1 and 3.6.1.2.3.2 of the Final EIS.

TGP will cross all waterbodies in accordance with FERC's Wetland and Waterbody Construction and Mitigation Procedures (with approved deviations), the pipeline project's SWPPP, and applicable state and federal regulations and permit conditions. Turbidity levels in shallow groundwater in proximity to blasting activities could potentially increase, but elevated levels are not expected outside of the immediate vicinity of the blasting and would likely only occur over a short period of time following the blasting. Sediments will disseminate on the ground surface and filter through substrate material prior to transport. Vibrations from blasting could potentially cause minor sediment influx in nearby wells but TGP will adhere to the considerations for public and private groundwater resources as outlined in the Blasting Plan provided in TGP's Resource Report 6 (TGP 2022f). These effects may be more likely in karst areas, where carbonate rock weathering is prevalent and fine-grained sediments have settled into void-structures of the shallow rock, but significant increases of turbidity in groundwater are not expected outside of the immediate blasting area and any potential occurrences would be only for a short duration.

No significant impacts are anticipated to occur to groundwater resources from construction and operation of the pipeline. Potential impacts on groundwater resources would be avoided or minimized by the use of both standard and specialized pipeline construction techniques.

Biological Resources

83. The DEIS' surveying efforts and analysis of impacts to birds and reptiles is incomplete and TVA admits that "targeted surveys for these particular species did not occur" and concludes that the proposed action is "not expected" to affect them given lack of recordings at this site and the existence of similar nearby habitat. TVA should commit to undertaking targeted surveys for these species prior to disturbance or clearing of habitat. This is necessary given that these species may be unable to relocate to nearby similar habitat when vegetation removal occurs. (Commentor: Southern Environmental Law Center)

Response:

TVA completed an ESA Section 7 consultation with the USFWS on July 20, 2022. See Appendix K to the Final EIS. As stated in the Draft EIS, there is a potential for direct effects to some individuals of listed bird and reptile species. However, impacts to local and regional populations are unlikely. Field surveys performed included traversing the CUF property on foot specifically to identify wildlife, including protected species, present. While targeted survey efforts for these federally protected species did not occur, trained wildlife biologists tasked with recording wildlife on site did not hear or see Bewick's wrens or Henslow's sparrows during multiple survey efforts. If they occurred at the site in large numbers, this would have been documented. In addition, there are no records from the TVA Regional Natural Heritage Database of these species within 3 miles of the CUF. Nor does TDEC report any records of the presence of the Bewick's wren or Henslow's sparrow in Stewart County. In addition, no records of these species from the CUF Reservation exist on eBird.org despite 83 other species being identified there since 2013. Given all of this data, the likelihood that these bird species currently

exist at this site is low, and performing targeted surveys for these species prior to disturbance or clearing of habitat is unnecessary.

Pygmy rattlesnakes are secretive and hard to observe as they are often underground. They may occur near water and occasionally in dry upland forested areas. Planned mitigation measures such as winter tree removal would avoid impacts to nesting pygmy rattlesnakes in upland forested areas. The planned site design was developed to minimize impacts to wetlands, as practicable, thereby minimizing impacts to this species. The TVA Regional Natural Heritage Database does not have any records of this species within 3 miles of the CUF. Both TDEC and TVA have records of this species elsewhere in Stewart County. Given minimization measures and winter tree removal, actions are not expected to impact populations of pygmy rattlesnakes though some individuals may be impacted should they be in burrows at the time of construction in the construction footprint.

See also response to *Comment No. 84*.

84. The DEIS fails to analyze broader impacts the alternatives will have on habitat and species within the project area. The DEIS fails to evaluate each alternative's contribution to climate change and the attendant effects on species. This analysis omits needed discussion regarding the foreseeable impacts operating a methane gas plant and pipeline will have on terrestrial and freshwater biology due to the leaking and/or combustion of gas and its addition to the atmosphere. TVA's DEIS fails to adequately analyze these foreseeable impacts; therefore, the assessment is incomplete. (Commentors: Southern Environmental Law Center, Center for Conservation Biology)

Response: Although the Draft EIS included an assessment of climate impacts; the Final EIS has been updated to provide additional evaluation and discussion of each alternative's potential to contribute to climate impacts and their potential effects on species.

The operation of a CC plant can contribute to climate change impacts. Climate change impacts on bird species typically includes expansion and/or shifting of ranges, reductions in habitat due to more frequent fire regimes, and potentially higher rates of nest failure related to spring heat waves or droughts. The current range of the Bewick's Wren is primarily in the southwestern U.S. and Pacific Coast; increasing warming scenarios project this species' range to expand north due to some portions of its range being lost in southern latitudes and the Pacific Northwest. The range of the Henslow's Sparrow is located mostly in the Midwest with scattered range in Pennsylvania, New York, and New England. Climate change projections show this species' range to become more restricted in the Midwest with greater warming and little range gained in northern latitudes. Based on known ranges of Bewick's Wren and Henslow's Sparrow, the effects of climate change are not expected to impact these species within the Project area.

Impacts to reptiles from climate change include changes in range, narrowing of reproduction windows, and impacts to habitat due to changes in fire regime, drought, and rainfall. Changes in range are particularly problematic for reptile species due to their limited mobility across the landscape; shifting of suitable habitat and range may occur faster than these species can feasibly move. Understanding the impact of climate change, including impacts within the Project area, on the pygmy rattlesnake is exceptionally challenging due to the secretive nature of this species.

Impacts to bats from climate change include loss of habitat due to increased frequency of fire, food reduction, and decreased survival due to drought and increased temperatures. Even within

secluded caves or other hibernacula, bats may be susceptible to isolated weather-related events if they are trapped due to intense rainfall, prolonged freezing temperatures, or if cave entrances become blocked with snow drifts and ice.

85. The DEIS' analysis of Alternative A's contribution to forest fragmentation and its effects on species is insufficient and incomplete. Rather, it acknowledges that construction of TGP's pipeline will require clearing 694 forested acres but foregoes any analysis by asserting that detailed review of resulting effects to listed species "are being conducted by TGP as part of their future FERC filings". (Commentors: Southern Environmental Law Center, Center for Conservation Biology)

Response: The original analysis and resulting acreage for forest clearing presented in the DEIS was based on a high-level desktop review of the corridor and clearly stated that it represents an overestimate of potential effects. Since issuance of the Draft EIS, TGP has completed their field surveys and further refined the potential area of effect for the gas pipeline, resulting in a reduction in acreage of anticipated forest clearing.

TGP concludes, "Long-term impacts on wildlife habitat due to construction and operation of the proposed Project will be limited to the clearing of upland and wetland trees required for temporary workspace and new permanent easement. To the extent practicable, feasible, and legally permissible, TGP has routed the pipeline to follow the existing TVA utility line easement, following existing forest edges, thereby minimizing the acreage of forested land crossed and the relatively greater impacts that could be associated with clearing an entirely new ROW through a contiguously forested area. For portions of the pipeline installed by open trenching, areas cleared for temporary workspace and for pipeline construction will quickly regenerate and provide additional open land habitat (i.e., scrub/shrub and old-field). These areas will not be maintained post-construction and will revert to forested habitat over time, much like land that has been previously cut during timber harvesting operations. Areas of early successional habitat that are impacted by construction will naturally revegetate within one to two growing seasons to their pre-construction condition and cover type" (TGP 2022c).

"The wildlife populations that use the Project area will not be permanently, adversely affected by the proposed pipeline. Although temporary impacts on food, cover, and water sources may occur, none of the species located within the Project area are specialized in such a way that construction of the pipeline will inhibit the overall fitness or reproductive output of the populations as a whole."

"Long-term impacts are limited to forested areas during operation of the proposed pipeline. The majority of the pipeline alignment is sited adjacent to a previously disturbed and maintained powerline corridor. This minimizes the amount of habitat fragmentation. However, unavoidable permanent impacts will occur to approximately 125.14 acres of forested upland and 0.02 acre of forested wetland as a result of vegetation management within the permanent easement, which will permanently convert these vegetative communities to open upland or emergent wetland types" (TGP 2022c). Further details are available in TGP's Resource Report 3 (TGP 2022c). TVA adopts TGP's conclusions.

Sections 3.8.1 and 3.8.4 of the Final EIS were updated to include greater detail and evaluation regarding potential for forest fragmentation and its potential effects on species from the Alternative A CC plant and transmission line and at specific locations along the natural gas pipeline lateral.

86. **The DEIS does not provide necessary information or analysis on its potential to impact listed bat species. TVA's analysis of the impact TGP's pipeline will have on listed bat species under Alternative A is insufficient and incomplete. TVA must include a completed bat strategy form in or appended to the final EIS so that the public may review the agency's proposed mitigation measures. (Commenter: Southern Environmental Law Center)**

Response*:* The Final EIS Section 3.8 provides a lengthy analysis of impacts to the biological environment, including impacts of Alternative A to threatened and endangered species. The Final EIS details consultation between TVA and the USFWS in the development of the 2018 Programmatic Biological Assessment to address the potential for impacts of specific TVA actions on federally listed bat species whose ranges overlap with the TVA action area, the development of a Programmatic Bat Strategy and USFWS Biological Opinion (BO) that concluded "the action is not likely to jeopardize the continued existence of the bat [Indiana bat] or the NLEB [northern long-eared bat]." In addition, the BO also included an Incidental Take Statement, which stated that the "action is reasonably certain to cause incidental take of individual bats [Indiana bats]." Due to the difficulty of detecting the take of Indiana bats, TVA must quantify the extent of take by using the annual and 20-year cumulative acreages of tree removal and prescribed burning under the programmatic action as a surrogate measure, as defined in the BO.

As stated in the Final EIS, tree removal at the plant site would occur between November 15 and March 31 and between October 15 and March 31 along the natural gas pipeline, thereby avoiding direct effects to many species of wildlife that breed/nest in the construction areas, including federally listed bat species. The Final EIS notes that several activities associated with Alternative A, including tree removal, were addressed in TVA's 2018 Programmatic Consultation with FWS on routine actions and federally listed bats, and TVA committed to implementing specific conservation measures when effects to federally listed bat species are expected. The TVA Programmatic Biological Assessment for Evaluation of the Impacts of TVA's Routine Actions on Federally Listed Bats, USFWS letter of concurrence, related USFWS Biological Opinion Amendment, and Bat Strategy Form are provided as Appendix L to the Final EIS and are available on TVA's external webpage at www.tva.com/nepa.

TVA determined that the work within the CUF Reservation may affect the Indiana bat and northern long-eared bat, and it will use approximately 42 acres of "take" for suitable bat habitat removal during the winter season consistent with the 2018 Programmatic Consultation. FWS approved of that approach and concluded that ESA Section 7 requirements have been fulfilled for the proposed Cumberland plant and transmission corridors.

The Final EIS also includes an analysis of potential impacts to bats from the construction and operation of the natural gas pipeline, drawing from updated information from TGP's Resource Report. TGP received a concurrence letter from the USFWS dated March 10, 2022, in which it stated that the pipeline is not likely to adversely affect any of the seven federally listed species, including the gray bat. The USFWS stated this correspondence concludes the coordination requirement of the ESA.

87. TGP's analysis of potential effects is inconsistent with the surveying efforts it did undertake and its efforts to affirmatively identify listed bat species which may be affected by its proposed pipeline have been inadequate. Moreover, the company appears to exclude from its analysis bat species which are proposed for federal listing or which

should be considered given their documented presence in counties along the proposed pipeline's path. Because TGP has failed to adequately gather information and analyze the effect its proposed pipeline could have on listed bat species, TVA cannot rely on its efforts or identified mitigation measures to conclude that the pipeline would not result in cumulative impacts to listed bats.

Despite the abundance of listed bat species which may be affected by TVA's preferred alternative and connected action, the Agency has failed to detail the conservation and mitigation measures it plans to take in order to protect these species in or appended to its DEIS. Pursuant to NEPA's mandate that environmental impact statements include discussion of appropriate mitigation measures; TVA must include this information in a final EIS for public review. (Commentor: Southern Environmental Law Center)

***Response**:* The species considered during the bat study included those listed on the USFWS Information for Planning and Consultation (IPaC) report, which also includes species proposed for federal listing as threatened or endangered. In a letter dated March 10, 2022, the USFWS concurred that the pipeline is not likely to adversely affect any of the seven listed species found in the project area. They further stated that the correspondence concluded the coordination requirement of the ESA. Since the time that the USFWS was consulted, the tricolored bat (*Perimyotis subflavus*) was proposed for listing as endangered by the USFWS (September 14, 2022). The mitigation measures developed in consultation with the USFWS would also minimize potential impacts to the tricolored bat as well as other bat species.

TGP states the following, "In accordance with USFWS recommendations to minimize impacts to migratory birds pursuant to the MBTA and protected bats, TGP will conduct tree clearing for [pipeline] construction and maintenance mowing during operations from October 15 to March 31. If tree clearing is required outside this window to accommodate construction, the necessary MBTA and bat surveys/consultations (including consultation with USFWS and TWRA) will be made" (TGP 2022c).

TGP's Resource Report acknowledges that "tree clearing associated within one mile of the Project area, together with other actions... may result in a cumulative impact on available habitat for the Indiana bat and northern long-eared bat but will not result in a cumulative impact on any known hibernacula or maternity roosts." Furthermore, TGP concludes "given that the species captured during the survey are ubiquitous on the landscape, the absence of federally threatened or endangered tree roosting bat species (i.e., Indiana bat), no known gray bat caves within 0.5 miles of the Project alignment, and with TGP proposing to implement appropriate Best Management practices, the proposed Project is not likely to adversely affect threatened and endangered bat species populations in the Project area." TVA adopts the conclusions of TGP Resource Report 3.

Impact analyses for protected bat species are provided in detail in the Final EIS in Sections 3.8.4.1.2 and 3.8.4.2.3; relevant USFWS consultations and programmatic documents are provided in Appendices K and L.

88. The DEIS' analysis of Alternative A's impacts to waterways and its effects on species is also insufficient and incomplete. The DEIS additionally fails to include a detailed analysis of environmental impacts TGP's pipeline construction and operation could have on listed species due to the pipeline's multiple stream crossings. This includes both

effects to aquatic habitat itself as well as effects on other species. (Commentor: Southern Environmental Law Center)

Response: The Draft EIS evaluated potential effects based on the best available information at that time. The Final EIS has been updated throughout, including specifically in the assessment of effects to waterways and species to include more detailed information regarding impacts to aquatic resources and wildlife. See the response to *Comment No. 106* for specific information about updated impact estimates to streams and wetlands for the Alternative A CC plant site; see *Comments No. 92, 95, 96*, and *97* regarding pipeline crossing methods/approaches and mitigation measures. Section 3.8.4 of the Final EIS has been updated to include greater detail and evaluation regarding protected species and Alternative A's risk of potential impacts at specific locations along the pipeline route.

89. TVA overlooks climate change impacts on wildlife affected by the project, unjustifiably relies on outdated and incomplete references to write off the project's impact on endangered species, including bats and mussels, and prematurely defers to FERC on the project's effect on sites on the National Rivers Inventory. The DEIS' reliance on outdated mussel surveys to forego a meaningful impact analysis is insufficient. ...the agency summarily concludes that neither the pink mucket or rabbitsfoot occurs within the vicinity of the CUF Reservation because the species were not recorded in a 2011 mussel survey of the thermally affected area of the Cumberland River and they "have not been collected in the area in decades." (Commentor: Southern Environmental Law Center)

Responses: See *Comment No. 84* regarding air quality and climate change effects from the proposed project. TVA addresses effects of climate change on wildlife, including protected species, in Section 3.7 and Section 3.8 of the Final EIS.

As stated in the Draft EIS, mussels were surveyed in the Cumberland River in the vicinity of CUF in 2011. No protected species were identified. No perennial streams are proposed for impacts for the construction or operation of the Alternative A CC plant. In-water work for the retirement of CUF and for barge upgrades has the potential to disturb or dislocate species along approximately 250 linear feet of shoreline. This would result in temporary impacts as increased turbidity and noise disturbance. Although a recent mussel survey was not performed, it is unlikely that the barge area provides suitable habitat for sensitive mussel species; this portion of the Cumberland River is widely regarded as being poor habitat for federally listed mussels, mostly due to the serial impoundment of the Cumberland River, ongoing operation of Cumberland Fossil Plant, and decades of continuous barge traffic. In recent consultation with the U.S. Fish and Wildlife Service, TVA made a No-Effect determination on federally listed mussels based on these factors and the USFWS acknowledged this determination with no comments in a letter dated July 20, 2022.

Mussel surveys were conducted in September 2021 by a qualified mussel surveyor at streams with potential habitat that would be crossed by the pipeline. During the survey, only one relic mussel shell of a common species (painted creekshell) was identified; no protected mussel species were observed. Standard sediment and erosion control measures, as well as horizontal direction drilling at larger streams, would be implemented to reduce impacts to any potential freshwater mussel species located in waterways within the Project area. See additional information regarding mussel surveys conducted in 2021 in Section 3.8.4.1 of the Final EIS.

Although it is unlikely that any protected mussel species are in the project area, TGP will use HDD for crossing three large and sensitive waterbodies, including those listed on the National Rivers Inventory, in order to minimize and/or avoid impacts from project activities. The remaining stream crossings required for pipeline installation would be crossed by dry open cut methods, which may include a dry-flumed crossing or a dam and pump depending on site-specific conditions at the time of construction. Dry open cut crossing methods would be accomplished by temporarily diverting stream flow around or through the work area to minimize contact between stream water and the excavation and to minimize sediment suspension during trench excavation, pipeline installation, and backfill activities. Following construction, streambeds would be restored to their pre-construction elevations and grades See responses to *Comments No. 92, 96*, and *97*.

See *Comment No. 87* addressing consultation with the USFWS regarding protected bat species.

90. [combined with other comment/response]

<u>Water Resources</u>

91: **The EPA recommends evaluating long term site planning and water requirements of proposed energy sources alongside projected river flows and water availability throughout the sources proposed service life. The EPA understands that the proposed alternative will primarily use air cooling for turbines and be somewhat resilient to decreased flows of the Cumberland River. However, a reversal of trends in this river basin could elevate the existing floodplain and present future climate-based challenges to energy resiliency. (Commentor: US Environmental Protection Agency)**

Response: Floodplains were considered when designing the Alternative A CC plant site, as evidenced by the final footprint presented in the Final EIS *(see* Section 3.5.2*),* in which the major components were shifted to locate them outside the floodplain. TVA has identified avoidance, minimization, and mitigation measures that consider the floodplain, and those measures would be implemented during Project activities identified in Section 2.3.1 of the Final EIS. Should the Cumberland River's flood elevations increase in the future, TVA would evaluate those future conditions for the need to implement measures to improve the resilience of flood-damageable structures and facilities that could be inundated at the higher flood elevations.

92. The DEIS impermissibly relies on mitigation to avoid a finding of significant cumulative impacts on surface water and wetlands from construction and operation of the CC plant and pipeline, without describing that mitigation. Although the DEIS does not identify it as a mitigation measure, TGP's Draft Resource Report 2 identified FERC's Wetland and Waterbody Construction and Mitigation Procedures as a source of measures—including BMPs—that it will use to mitigate the effects of its activities on surface water and wetlands. By not providing supporting analytical data regarding FERC's procedures—let alone citing it, the DEIS falls short of legal requirements. In its NEPA review, TVA must take a hard look at the environmental effects of using those procedures. (Commentor: Southern Environmental Law Center)

Response: Through finalization of the siting of the proposed CC plant and in consultation with the agencies with respect to the natural gas pipeline, impacts to surface waters and wetlands will be avoided and minimized to the maximum extent practicable. The only permanent impacts proposed to surface waters due to fill consists of approximately 250 linear feet (lf) of shoreline of

the Cumberland River for the barge unloading area upgrades; no perennial streams or wetlands are proposed for permanent impacts due to discharges of fill to these waters.

Permanent impacts are proposed for approximately 1,473 lf of ephemeral conveyances within the CC plant footprint, approximately 1,106 lf of ephemeral conveyances within the switchyard, and 865 lf of ephemeral conveyances within the construction support area. Proposed activities meet the conditions of Section 69-3-108(q) (Waters, Waterways, Drains and Levees), which allows for alterations to these channels without application or notice to Tennessee Department of Environment and Conservation (TDEC).

Temporary impacts to surface waters consist of impacts to 1,100 linear feet of perennial, intermittent, and ephemeral channels from pipeline construction. The pipeline will cross streams through the corridor by dry open-cut, which involves dry-flumed crossing or a dam and pump-around method to minimize impacts to water quality from turbidity. After construction is complete, streambeds, including elevations, will be returned to pre-construction condition. Temporary effects will not result in long-term impacts.

Permanent impacts to wetlands consist of wetland habitat conversion from forested wetland to emergent or shrub-scrub type wetlands. Approximately 2.1 acres of forested wetlands falls within the transmission line corridors and would be cleared for transmission line construction. Regular vegetation maintenance within the transmission line corridor would be required long term for the safe and reliable operation of the transmission lines. Although no dredge or fill impacts are proposed to these wetland areas, their function and habitat would be permanently changed.

TVA would coordinate with and obtain applicable USACE and TDEC permits for regulated impacts to jurisdictional features, and comply with all permitted terms and conditions, including provision of any required compensatory mitigation. In addition, TVA would implement best management practices to limit direct and indirect impacts to waterbodies and wetlands.

The purpose of FERC's Wetland and Waterbody Construction and Mitigation Procedures (“the Procedures”) is to "assist project sponsors by identifying baseline mitigation measures for minimizing the extent and duration of project-related disturbance on wetland and waterbodies." The Procedures is a publicly available document that provides FERC’s mitigation procedures for pipeline crossings that are part of pipeline projects reviewed by FERC.

Detailed mitigation measures and BMPs are provided in Section 3.8.3.2.3 of the Final EIS.

93. The DEIS demonstrates that there are practicable alternatives to Alternative A’s potential to affect hundreds of acres of floodplains. Analysis of floodplains is therefore siloed to considering those alternatives which would still execute construction and operation of a methane gas plant and pipeline. However, Conservation Groups note that other alternatives analyzed in the DEIS—specifically Alternative C—are practicable and have the potential to eliminate or minimize effects to floodplains. When analyzing Alternative C, the DEIS states that specific sites “have not yet been determined for evaluation” of siting solar and storage facilities but that these structures “would be sited in a manner to avoid floodplains to the extent feasible.” Therefore, it is entirely possible that implementation of Alternative C would have little to no impact on floodplains. And even utilizing TVA’s own calculations in the DEIS regarding typical effects solar facilities have on floodplains, the agency estimates that Alternative C may result in 60 acres of floodplain effects. (Commentor: Southern Environmental Law Center)

Response: The updated Alternative A CC plant footprint illustrated in the Final EIS shows that floodplains would be avoided aside from transmission line construction activities. As stated in Section 2.1.3.2.2 Natural Gas Pipeline of the Final EIS, the gas pipeline would be buried; therefore, floodplain impacts would be temporary and limited to pipeline construction and subsequent maintenance of above-ground appurtenances. Buried utilities are considered by TVA to be repetitive actions in the 100-year floodplain (TVA 1981), and the mitigation measures listed in Section 2.3.1 of the Final EIS would minimize adverse impacts to floodplains. As to Alternative C, although it is feasible that floodplain impacts could be partially avoided, the large acreage of land required could result in impacts to wetlands, waters of the U.S., and/or floodplains. As noted in Table 3.2-1 of the Final EIS, average impacts from solar facility construction include approximately 0.02 acre per MW of floodplain fill and approximately 0.14 acres of wetlands affected. Because exact site locations for solar and storage facilities are not known at this time, additional site-specific analyses would need to be completed as projects are identified and their scope is defined.

See also response to *Comment No. 92* for discussion of the Final EIS analysis of wetlands impacts.

94. The DEIS's evaluation of the effects on wetlands from implementation of Alternative A is insufficient. Despite the acknowledged existence of nearly 30 acres of healthy, well-functioning wetlands providing important ecosystem services, the DEIS fails to describe the effects of CC Plant construction and operation on wetlands. The DEIS states, without further elaboration: "Approximately 29.4 acres of wetlands are within the proposed plant site and may be directly or indirectly effected [sic] by construction of the plant. During the design of the plant, TVA would avoid and minimize effects to wetlands as practicable." (Commentor: Southern Environmental Law Center)

Response: The Final EIS addresses the revised, smaller footprint for the Alternative A CC facilities on the Cumberland Reservation, where impacts to wetlands are minimized to the extent practicable. *See* Section 3.6.3 of the Final EIS.

95. The DEIS does not acknowledge—let alone evaluate—the widespread use of in-stream blasting for construction of the pipeline. As discussed above, TGP has stated that it intends to blast through 27% of its 131 waterbody crossings for the pipeline—or approximately 35 crossings. The DEIS's lack of acknowledgement of in-stream blasting and its consequences provides a concrete example of why, as discussed throughout these comments, the DEIS is entirely premature, incomplete and inadequate. By releasing the DEIS before TGP disclosed its intent to conduct in-stream blasting at approximately 35 locations, TVA violated NEPA's "rule of reason" because the DEIS's "deficiencies are significant enough to undermine informed public comment and informed decision making. (Commentor: Southern Environmental Law Center)

Response: Since the time the DEIS was issued, TGP has updated its proposed approach to stream crossings and bedrock excavation. The Final EIS has been updated to incorporate in its analysis the latest information from TGP's Resource Reports. In sum, based on review of surficial geology, soil mapping, and desktop geotechnical survey results, excavation of shallow bedrock may be required in some areas. TGP proposed four techniques to be evaluated and/or attempted prior to resorting to controlled blasting techniques, including 1) conventional excavation with an excavator; 2) ripping with an excavator equipped with a ripping tooth,

followed by conventional removal by excavator; 3) hammering with a pointed backhoe attachment or a pneumatic rock hammer, followed by excavator excavation; or 4) removal by rock trencher. At stream crossings, TGP will first perform an evaluation to determine the best method of rock removal and excavation, and will attempt at least one of four previously listed techniques prior to resorting to controlled blasting. If the initial technique is unsuccessful for rock removal and excavation at stream crossings, Technique 5 (controlled blasting) will be considered in non-karst areas that are also not in wetlands or streams with an unacceptable risk of hydrologic loss. The risk of karst-prone geology and risk of unacceptable hydrologic loss has been evaluated as part of the USACE Individual Permit Application for each stream crossing location at which a bedrock substrate has been identified.

As detailed in TGP's Resource Report 6, if controlled blasting is necessary at a waterbody or wetland crossing, TGP's construction contractor will utilize a dry-ditch crossing method (either dam-and-pump or flume crossing) and adhere to 1) all applicable federal, state, and local regulations, including the FERC Procedures, USACE and TDEC permit conditions, 2) Draft Blasting Plan, and 3) karst mitigation measures.

96. The DEIS does not evaluate the environmental consequences of proposed pipeline stream-crossing methods. The DEIS is devoid of meaningful analysis of the environmental consequences of pipeline stream crossing, only acknowledging the potential for direct and indirect effects. Horizontal directional drilling under streams raises the potential for environmental impacts from frac-outs not addressed in the DEIS. TGP intends to use HDD at three crossings (Jones Creek, Yellow Creek, and Wells Creek). Although HDD avoids direct impacts to waterbodies and streambeds by going under an aquatic resource, instead of through it, the technique's use of large quantities of drilling muds presents the risk of inadvertent returns. Indeed, TGP acknowledges the risk of "inadvertent release of drilling fluids to the surface along the pipeline alignment during drilling operations" through hydraulically induced fractures. Such releases can have severe impacts on water quality and aquatic life, by smothering streambeds and wetlands with drilling mud. TVA's DEIS does not even acknowledge the risk of inadvertent return, let alone examine the environmental impacts of such a release. But it must do so under NEPA. Because two of the three streams at which TGP intends to use HDD—Jones Creek and Yellow Creek—are streams on the National River Inventory created by the Wild and Scenic Rivers Act, 454 TVA must evaluate the consequences of an inadvertent return in the context of the environmental and other values of those sensitive resources. (Commentor: Southern Environmental Law Center)

Response: The Final EIS has been updated to provide a more detailed discussion of the pipeline's proposed stream crossings. There are advantages and disadvantages to all stream crossing methods. Risks associated with horizontal-directional drilling (HDD) include inadvertent returns during drilling operations resulting in the loss of drilling fluid through hydraulically induced fractures, drilled hole collapse during drilling or reaming, and pipeline inaccessibility for visual inspection of the pipe and repairs post-construction; however, compared to the other crossing methods, the HDD technique minimizes the impacts to an area by drilling down and under a sensitive resource, leaving the portion of land in between the entry and exit points relatively undisturbed. The risk of inadvertent return from the HDD method and its effects on the environment are discussed in the Final EIS. Evaluation and potential impacts of the HDD

approach is provided in Section 3.6.2.2.3 of the Final EIS along with other proposed stream crossing methods.

TGP's Draft HDD Contingency Plan establishes procedures for addressing potential impacts associated with a release of drilling fluid through hydraulically induced fractures during the HDD process. TGP will provide updates on the updated plan to FERC. Based on these changes and updates, TVA will evaluate the need to supplement or update its analysis, as appropriate.

97. Wet open-cut crossings are environmentally devastating. It is hard to envision a more damaging stream-crossing construction method than a wet open-cut crossing. Yet, TGP intends to use that method for 128 of its 131 stream crossings. The wet open-cut technique "does not use any method to divert the stream around the work area. The utility line is installed and backfilled while the river/stream continues to run through the site." As one state regulatory agency has concluded, "this type of crossing produces some very negative impacts. These include severe pollution from greatly increased total suspended sediment (TSS) concentrations, changes in channel morphology, and localized destruction of aquatic ecosystems." And the Corps has argued against the use of wet open cut crossings in court filings, admitting "that downstream sedimentation can be 100 times greater during wet open-cut construction than during" construction using other methods. (Commentor: Southern Environmental Law Center)

Response: See response to *Comment No. 96* regarding the Final EIS evaluation of the pipeline's stream crossings. Since the time the DEIS was issued, TGP has updated its planned approach to stream crossings. Use of wet open-cut crossings is not anticipated. With the exception of four streams/rivers to be crossed via HDD, all other streams will be crossed by dry open-cut methods using either a pump-around or flume approach. Dry open-cut crossing methods will be accomplished by temporarily diverting stream flow around or through the work area (via pump-around or flume) in order to minimize contact between stream water and the excavation and to minimize sediment suspension during trench excavation, pipeline installation, and backfill activities, thereby reducing overall impact. See Section 3.6.2.2.3 of the Final EIS for a discussion of the dry open-cut method.

98. TVA relies on mitigation to dismiss the project's surface water and wetlands impacts without explaining what mitigation it means to employ; leaves unanswered critical questions about Alternative A's wetlands impacts; says nothing about the dozens of sites where blasting in streams would carve out the pipeline's route; and fails entirely to evaluate alternatives that could lessen the project's impacts on streams and wetlands. (Commentor: Southern Environmental Law Center)

Response: The Final EIS provides an updated, more detailed analysis of the pipeline's impacts to surface waters and wetlands in Sections 3.6.2.2.3 and 3.6.3.2.3, drawing from the information included in TGP's Resource Reports. See response to *Comment No. 106* for specific information about updated impact estimates to streams and wetlands for the Alternative A CC plant site; see *Comments No. 92, 95, 96*, and *97* regarding pipeline crossing methods/approaches and mitigation measures.

TGP will ensure that construction impacts are appropriately addressed through adherence to permit conditions and implementation of the protective measures in the FERC Plan and FERC Procedures (with requested deviations), and the Project-specific HDD Contingency Plan,

Blasting Plan, and Hydrostatic Test Plan. See Final EIS Section 3.6.3.2.3 for additional information regarding wetland mitigation measures.

99. Dry open-cut crossings cause long-lasting, significant impacts on water quality and aquatic life. Although TGP states in Draft Resource Report 2 that it "is not proposing any dry crossings for the project," it also acknowledges that any number of regulatory agencies might require it to use that technique. Consequently, TVA should have taken a hard look at the environmental impacts to water quality and aquatic life from proposed dry open-cut crossings as well. The duration of adverse environmental effects from dry open-cut crossings are measured in years—not days. (Commentor: Southern Environmental Law Center)

Response: There are advantages and disadvantages to all stream crossing methods; however, the dry open cut approach is the most practical, least impactful, and least risky stream crossing method. Temporarily diverting stream flow around or through the work area will minimize sediment suspension during trench excavation, pipeline installation, and backfill activities.

See also response to *Comment No. 97*.

100. Army Corps regulations prohibit the use of a nationwide permit when any other part of the larger project requires an individual permit. The construction of the CC plant under Alternative A will require an individual Section 404 permit. Because the pipeline is an integral part of the larger project, it too will require an individual permit for its proposed stream crossings and TVA must not assume it is eligible for authorization under NWP 12. (Commentor: Southern Environmental Law Center)

Response: This comment addresses the 404 permitting requirements for the project, which will be addressed through the USACE section 404 permit process. The construction of the CC plant and transmission assets and the barge dock upgrades under Alternative A will comply with USACE Section 404 water permitting regulations. TVA will coordinate CWA 404 permitting for the impacts of Alternative A to regulated waters with the USACE to obtain the necessary and appropriate permits pursuant to the USACE's CWA Section 404 permit program. TGP submitted a USACE Section 404 Clean Water Act / Section 10 Rivers and Harbors Act Permit Application for the pipeline portion of Alternative A on July 22, 2022. See TGP's Resource Report 1, Table 1.8-1 (Permit Table).

101. The DEIS should have evaluated alternatives to avoid and minimize the environmental effects from discharges of dredged and/or fill material to identify the least environmentally damaging practicable alternative. Where a federal action requires a CWA Section 404 permit, there is a relationship between NEPA's alternatives analysis and the substantive requirement of the Section 404(b)(1) Guidelines that condition the issuance of a Section 404 permit on the identification and implementation of the least environmentally damaging practicable alternative. The DEIS is silent on alternatives to avoid and minimize stream and wetland effects from CC plant construction and operation.

The DEIS is silent on alternatives to avoid and minimize stream and wetland effects from upgrades to barge facilities. TVA should have evaluated the location and construction method proposed for each individual crossing. NEPA and the Section 404(b)(1)

guidelines require an evaluation of route alignment alternatives for each crossing. NEPA and the Section 404(b)(1) guidelines require an evaluation of the feasibility of less destructive trenchless-crossing methods. (Commentor: Southern Environmental Law Center)

Response: In accordance with CWA Section 404(b)(1) guidelines and Executive Order 11990, and as stated in the Final EIS, proposed impacts to regulated aquatic features shall be avoided and minimized to the extent practicable during the siting process. The scope of the EIS allows for consideration of potential impacts to resources under each alternative, as captured in Table 2.2-1.

Site specific avoidance and minimization measures would be implemented in final site design and will be addressed by the Corps of Engineers through the CWA section 404 permit process. In evaluating and processing the application for CWA section 404 authorization, the Corps will comply with its obligation to evaluate whether there are less environmentally damaging practicable alternatives to the proposed action under the CWA section 404(b)(1) guidelines. While it is true that NEPA documents may provide sufficient information for evaluation of alternatives under the CWA section 404(b)(1) guidelines, there is no requirement for all review to occur in one document. Consistent with its obligations, the Corps will consider impacts from the proposed action and alternatives and may draw upon TVA's EIS in its evaluation.

Impacts from upgrades to the barge facilities are localized to the area immediately surrounding the existing barge. As stated in the Final EIS, upgrades would consist of grading and creation of dirt/rock ramping to the nose of the barge as well as potential concrete resurfacing and widening. Impacts to surface waters include disturbance to approximately 250 linear feet of the Cumberland River related to the barge upgrade activities.

See *Comments No. 95, 96, 97*, and *99* for further information on proposed waterbody crossing methodology and evaluations related to the natural gas pipeline.

102. As the area to be disturbed will be more than 50 acres in size, the project will require an additional construction stormwater permit (GCP) and a project-specific Surface Water Pollution Prevention Plan. Additional permits will need to be modified and required. (Tennessee Department of Environment and Conservation)

Response: While the project area is over 50 acres in size, to minimize erosion and limit sedimentation, construction efforts will be phased such that active disturbance is less than 50 acres in conformance with Tennessee's NPDES general permit TNR100000 for stormwater discharges from construction activities. TVA will develop a site-specific Stormwater Pollution Prevention Plan (SWPPP) and will submit the SWPPP as a part of the project's Tennessee General Construction Stormwater Application.

<u>Other Resources</u>

103. TVA must acknowledge the risk of a pipeline explosion. TVA must disclose and address the safety issues associated with the pipeline, examine the potential for those issues to have disproportionate adverse impacts on environmental justice populations, and must consider how selecting an alternative that does not require a new gas pipeline could mitigate those dangers. (Commentor: Southern Environmental Law Center)

Response: The Final EIS addresses the risk of pipeline explosions and the potential impacts of such explosions on the environment and on environmental justice populations. A number of

policies and programs have been put in place to minimize and mitigate risks to safety and the environment, as detailed in Section 3.15.3.4.2 of the Final EIS. Safety-related effects that would occur as a result of the proposed construction and operation of the CC plant and installation of the natural gas pipeline would be temporary and minor, and they would be mitigated per implementation of BMPs and adherence to OSHA regulations. Further, the use of BMPs and compliance with OSHA and USDOT Pipeline and Hazardous Materials Safety Administration requirements minimize the potential for pipeline explosions and their effects to surround residents.

104. Advocates that reinvestment in and support for the communities currently and previously supported by the coal plant work is needed. TVA should provide workers with proper training, ideal working conditions, livable wages and ensure their safety. (Commentor: Touch Grass Nash)

Response: TVA is developing a detailed Workforce Plan to support employees through this transition. The Plan will include opportunities for employees to transfer to other TVA locations where employee skillsets are needed, to gain skillsets for transitioning to a new job in TVA, or to identify external opportunities if that best meets employee needs.

105. A petition submitted with comments and 129 Signatures was submitted indicating support for the retirement of one unit at the Cumberland Plant in 2026, and the second unit shortly thereafter, and emphasized the need to ensure a just transition for the plant employees and the community around Cumberland City. The commentor recommends development of training programs and apprenticeships to transition workers to high-paying, safe, sustainable jobs. (Commentor: Clean Up TVA Coalition)

Response: TVA has addressed this comment in Section 3.16 of the Final EIS. Although there would be long-term employment loss under Alternative A and a net employment decrease during and after plant construction and pipeline operation, there will be new short-term employment options that would arise due to the construction of the CC plant and corresponding pipeline.

See also the responses to *Comments No. 63* and *104*.

Avoidance, Minimization, Mitigation

106. CUF contains several wetlands and tributaries to the Cumberland River. The proposed pipeline corridor parallels an existing transmission line corridor that crosses interspersed creeks and wetlands. TVA will potentially impact 7,239-Linear Feet (LF) of streams and 29.4-acres of wetlands at the power plant site, and 11,620-LF of streams along the pipeline corridor. Additional impacts from in-water work along the Cumberland River may result from planned upgrades to existing piers. The EPA understands that TVA is coordinating with the U.S. Army Corps of Engineers (USACE) regarding impacts to Waters of the United States (WOTUS). The EPA recommends continued coordination with USACE to acquire mitigation credits within the Cumberland and Tennessee River watersheds. (Commentor: US Environmental Protection Agency)

Response: The DEIS provided a lengthy analysis of impacts to water resources, including impacts of Alternative A to groundwater, surface water and water quality, and wetlands. The DEIS included analysis of impacts from the construction and operation of the natural gas pipeline to water resources based on the best information available during the preparation of the

DEIS. The Final EIS provides an updated, more detailed analysis of the Project's impacts to groundwater, surface water and water quality, and wetlands. In particular, the Final EIS incorporates information from TGP's Resource Report 2, addressing impacts to groundwater, surface waters, water quality, and wetlands from crossings associated with the proposed pipeline based on extensive field surveys.

The proposed CC plant, associated transmission lines, and natural gas pipeline have been sited and aligned to minimize impacts to surface waters and wetlands to the maximum extent practicable. The Final EIS concludes that, with the use of proper BMPs and CWA section 404 and 401 permitting and mitigation, cumulative impacts to wetlands and surface waters would be minor. Consistent with EPA's recommendation, TVA continues to coordinate with the USACE regarding the required CWA section 404 permitting and compensatory mitigation. TVA plans to submit applications for required CWA 404 USACE permitting to address any proposed impacts to WOTUS features resulting from proposed project activities from the CUF plant, while TGP will apply for CWA 404 permitting coverage for the pipeline. TVA understands impacts are subject to compensatory mitigation requirements and would coordinate with the USACE to ensure that appropriate compensatory mitigation is provided by acquiring mitigation credits from wetland banks in the appropriate watersheds.

107. The EPA principally defers to the U.S. Fish and Wildlife Service (FWS) regarding compliance with the Endangered Species Act and recommends early coordination. Results of FWS consultation should be included in the FEIS. (Commentor: US Environmental Protection Agency)

Response: Comment noted. TVA completed an ESA Section 7 consultation with the USFWS on July 20, 2022. See Appendix K to the Final EIS. In addition, TVA notified USFWS of a minor change in scope resulting in additional tree clearing on August 19, 2022. USFWS acknowledged this notification on August 26, 2022 Details of the impact determinations and consultations are included in Section 3.8.4 of the Final EIS. USFWS's letter of concurrence as well as TVA's documentation of compliance with TVA's Programmatic Consultation with USFWS regarding routine actions that may affect federally listed bats are included as an appendix to the Final EIS. USFWS responded to FERC's notice of scoping on March 22, 2022 (FWS #2022-0011291) with concurrence on TGP's ESA Section 7 determinations for the pipeline project. Details of USFWS's response are also included in the Final EIS.

108. TVA should continue to coordinate with the State Historic Preservation Office on matters related to archaeological sites in the path of the gas pipeline. (Commentor: US Environmental Protection Agency)

Response: The gas pipeline project is being proposed by a third party and will require approval by FERC. Therefore, FERC is responsible for complying with the National Historic Preservation Act (NHPA) and completing the NHPA Section 106 review process for the pipeline. Archaeological sites have been identified within the proposed pipeline corridor. To fulfill its obligations under Section 106 of the NHPA, FERC will consult with the Tennessee State Historic Preservation Office (TN SHPO) and federally recognized Indian tribes regarding specific effects to cultural resources along the pipeline corridor.

TVA has also consulted with TN SHPO regarding potential visual effects to the Hollister House. Consultation on that resource has concluded with a Memorandum of Agreement between SHPO and TVA, signed on September 29, 2022.

See Final EIS sections 2.3.2, 3.13 and 3.19.

109. Section 3.7.2.3.1 of the DEIS discusses the potential climate impacts from increases in ambient temperature on combustion turbine operational efficiency and potential impacts of flooding on the project. The DEIS also indicates that TVA has developed a Climate Action Adaptation and Resiliency Plan to identify risks associated with and plan for climate change effects. We recommend that the FEIS specifically reference or provide a link to this plan, as well as refer, in the climate section, to the flood mitigation measures that are included elsewhere the document.

The EPA also recommends that the FEIS address whether and to what extent each of the alternatives is resilient or vulnerable to outages, with the expectation that climate change will increase impacts that could affect risks to reliability. If TVA plans to cite reliability as a concern related to Alternative C, the EPA recommends that TVA detail the modeling scenarios that produce electricity supply shortfalls. (Commentor: US Environmental Protection Agency)

Response: Section 3.7.2.3.1 of the Final EIS has been updated to reference TVA's Climate Action Adaptation and Resiliency Plan and includes the flood mitigation measures that are referred to in other places of the document in the climate section.

Under Alternative C, significant storage facilities and transmission system upgrades would be required. TVA performed a reliability assessment in the development of Alternative C, which resulted in the stated need for 1,700 MW of battery storage (see Section 2.1.5.2.1 of the Final EIS). TVA's Reserve Margin study considers outage and availability risks for all resource types in its evaluation. Additional clarification and discussion regarding resiliency and climate change effects is provided in Section 3.7.2 of the Final EIS.

110. The DEIS's analysis of the project's impacts on public lands is unsupported and premature. First, TVA's belief that TGP's installation process to place its pipeline under Yellow and Jones Creeks through directional drilling would cause only "minor" impacts to NRI waterbodies ignores the risk that horizontal-directional drilling ("HDD") poses to waterways. As outlined above and in our Scoping Comments to FERC regarding the proposed pipeline, which Conservation Groups incorporate by reference here, HDD requires the use of large quantities of drilling muds and can cause inadvertent returns which can have severe impacts on water quality and aquatic life. Further, TVA's finding is premature because—as acknowledged in the DEIS—TGP has not committed to utilizing HDD to cross these waterbodies. Further, it is unclear whether FERC has finished consulting with NPS about the effect these crossings could have on Yellow and Jones Creek. (Commentor: Southern Environmental Law Center)

Response: The Final EIS clarifies the risks of utilizing the HDD method in Section 3.2.2.2 and includes updated information regarding the status of the NPS consultation in Section 3.6.2 of the Final EIS. See TGP's Resource Reports 1, 2, 6, and 8 and Appendices 1.D.4 (Draft HDD Contingency Plan and 1.D.10 Draft HDD Feasibility Studies). No public or conservation lands have been identified that would be impacted by the project facilities.

The HDD Feasibility Study indicates that utilizing HDD at all three crossings (Jones Creek, Yellow Creek, and Wells Creek) is feasible and the least intrusive method. The successful utilization of HDD at each proposed site will ultimately be determined by the ability to maintain

clean and open drill holes, maintain the drilling mud within reasonable rheological properties, and achieve the minimum depth of cover. The SHPO has issued clearance for the Avoidance Plan at the Yellow River, and the TWRA has confirmed that no seasonal restrictions will be necessary. See agency correspondence with National Parks Service in TGP's Appendix 1.F to Resource Report 1 for consultation regarding NRI waterbodies.

See also *Comments No. 96* and *97*.

111. The EPA recommends continuous monitoring of surface water discharges in accordance with TVA's industrial stormwater and construction stormwater permits, and maintenance of BMPs, to ensure pollutants do not enter WOTUS. The Proposed Action Alternative will create impervious surfaces that should be managed with attenuation features to maintain existing stormwater runoff profiles. (Commentor: US Environmental Protection Agency)

***Response*:** Comment noted. Prior to commencement of construction, TVA would seek coverage under Tennessee General Construction Stormwater Permit TNR100000 by submitting an NOI. Silt fences, sediment basins and/or other sediment and erosion control measures, as described in A Guide for Environmental Protection and Best Management Practices for TVA Construction and Maintenance Activities, Revision 3 (2017a), would be installed and maintained as needed for the duration of the proposed project to avoid contamination of surface water adjacent to the project area. The Cumberland Fossil Plant operates under an existing Tennessee Stormwater Multi-Sector Permit for Industrial Activities (TNR050000). This permit would be modified to include the post construction industrial stormwater discharges associated with the proposed CC plant. See Final EIS Section 3.6.2.

112 For the protection of drinking water resources, WOTUS, and as required by the Clean Water Act, the EPA recommends the use of secondary containment where storage and handling of Petroleum, Oils, and Lubricants (POL) will take place. Where secondary containment is not directly practicable, spill ponds and oil water separators should be constructed downstream of POL related activities. Construction and operation in support of the project should ensure that Resource Conservation and Recovery Act-regulated solid wastes generated are disposed of in accordance with federal regulations. (Commentor: US Environmental Protection Agency)

***Response*:** The Cumberland Fossil Plant currently has a Spill Pollution, Control, and Countermeasures (SPCC) Plan as required by 40 CFR Part 112, Oil Pollution Prevention, and a Stormwater Pollution Prevention Plan (SWPPP) as required by Tennessee Stormwater Multi-Sector General Permit for Industrial Activities No. TNR051933. The CC plant will be added to the existing plans throughout construction in addition to obtaining a Tennessee Construction Stormwater Permit. Further, TVA will ensure that Resource Conservation and Recovery Act-regulated solid wastes generated during construction and operation are disposed of in accordance with federal regulations. See EIS Section 3.6.1.

PROCEDURE AND OPPORTUNITIES FOR PUBLIC INPUT

113. TVA has not explained what version of the NEPA regulations the agency is applying, but regardless its choices are limited. (Commentor: Southern Environmental Law Center)

Response: TVA's regulations for implementing NEPA are found at 18 CFR Part 1318. In addition, CEQ regulations are found at 40 CFR Parts 1500 – 1508. The Notice of Intent to

prepare the EIS was issued in May, 2021, at which time the July, 2020 revisions to the CEQ regulations were in effect. The preparation of the EIS aligns with the requirements of the 2020 version of the CEQ regulations as well as CEQ's 2022 amendments to the regulations, which went into effect shortly before the DEIS was issued for public comment, as addressed in Section 1.6 of the Final EIS. As standing practice, TVA applied long-standing NEPA principles and generally used the same procedures it has in previous NEPA analyses. For instance, the EIS impact analysis addresses direct, indirect, and cumulative effects of the alternatives, including GHG emissions and climate change. This analysis complies with the 2020 and 2022 CEQ regulations as well as TVA's own NEPA regulations.

114. TVA has undermined full and informed public participation in the NEPA process by failing to disclose the information needed to assess and comment on the DEIS, by refusing to extend the comment period, by impermissibly segmenting its review of the methane gas pipeline's environmental impacts and purporting to rely on Tennessee Gas Pipeline Company's ("TGP") incomplete analysis of pipeline impacts, and by ignoring other threshold questions about the scope and framing of the DEIS's analysis, including the relationship of the proposed methane gas plant to the additional 3500 MW of new gas plants TVA has recently proposed. TVA has refused to provide Conservation Groups additional time to address the missing information, interfering with public comment on the DEIS. (Commentors: SELC, SACE)

Response: As detailed in Final EIS Section 1.4, TVA has provided extensive opportunities for public involvement throughout the CUF EIS process, consistent with NEPA requirements. The public was first made aware of TVA's intent to study the proposed retirement and replacement generation of the Cumberland Fossil Plant in May 2021. A public scoping period ran from May 11, 2021 to June 10, 2021. A virtual public scoping meeting was held on May 27, 2021. Public scoping comments were considered in preparation of the Draft EIS. The Draft EIS was posted on TVA's website on April 25, 2022 and the Notice of Availability (NOA) was published in the Federal Register on April 29, 2022, opening a 45-day public comment period that closed on June 13, 2022. TVA has also provided other opportunities for the public to express their views on the proposal through acceptance of formal comments, a virtual public meeting on May 12, 2022, virtual open house (available April 25 – June 13), or in-person, at public open houses on May 17 and 18, 2022.

Stakeholders have had additional opportunities to provide feedback to TVA on this and other topics through forums such as the TVA Board of Directors public listening sessions in August and November of 2021, and February and May of 2022, and an open public comment opportunity on May 23, 2022, at the meeting of the Regional Energy Resource Council.

TVA engaged external stakeholders in several ways during the development of the CUF EIS. TVA used virtual meetings, in-person meetings, posted various materials online and in public libraries. TVA provided direct mailings, posted in newspapers, distributed flyers, and had multiple public comment periods.

TVA contacted local officials and leaders, schools, and community action organizations in and around the Cumberland Plant. TVA partnered with the Highland Rim Economic Corporation to identify potential EJ communities, as well as distribute information to these communities. TVA provided water and factsheets during the Highland Rim Economic Corporation's commodity distribution event. TVA also engaged with multiple schools local to the Cumberland plant. TVA

provided a pizza party and distributed coloring books with project information/factsheets. TVA placed hard copies of the Draft EIS in three local libraries, and sent hard copies directly to households when requested.

TVA carefully considered the points outlined in SELC's request to extend the 45-day DEIS comment period and concluded that, in light of these extensive opportunities for public participation, the information identified in the letter did not warrant extending the time period for public comment on this EIS.

As noted in TVA's correspondence with SELC on this topic, the information that TVA has relied on in drawing conclusions in the Draft EIS was provided in the text of the Draft EIS itself, incorporated by reference in the Draft EIS, or otherwise already available to the public. The same is true for the Final EIS.

See response to *Comment No. 9* regarding the EIS's evaluation of the pipeline's impacts. See also response to *Comments No. 19 and 58* regarding the Final EIS's discussion of TVA's system-wide planning, which is subject to robust public input through the IRP process and related EIS.

115. **To allow for informed comparison between alternatives, agencies must "ensure the professional integrity, including scientific integrity, of the discussions and analyses in environmental documents," must "make use of reliable existing data and resources[,]" and must disclose "incomplete or unavailable information". A federal agency violates NEPA when it "presents information that is so incomplete or misleading that the decisionmaker and the public could not make an informed comparison of alternatives. (Commentors: Southern Environmental Law Center)**

Response: As indicated in the response to *Comment No. 114*, TVA has made available information that it has relied on in drawing conclusions relevant to the determination of reasonably foreseeable significant adverse impacts that are essential to a reasoned choice among alternatives.

116. Comments provided on Figure 2.1-1:

- **If access points to the CUF reservation end up changing from Cumberland City Road, coordination is required with TDOT**
- **During construction, coordinate with TDOT on lane closures and countermeasures since Cumberland City Road is a state route**
- **Will these overhead structures (referring to structures that cross from coal pile to loading areas on Cumberland River) be removed? If they are removed the necessary countermeasures will need to be in place in order to assure motorists are protected.**

(Commentor: Tennessee Department of Transportation)

Response: Comment noted. TVA will coordinate with TDOT as needed during construction to identify and implement necessary countermeasures to assure motorist safety.

117. Multiple commentors indicated support for the retirement of the Cumberland Fossil Plant and replacing generation with either Alternative A or Alternative B, as identified in Part C of this Appendix.

Response: Your support has been noted.

118. Multiple commentors expressed opposition to the proposed retirement of Cumberland Fossil Plant or support retirement but encourage TVA to select Alternative C or other renewable or clean energy option.

Response: Your comment has been noted.

C. Summary of Commentors

Commentor - Affiliation (Comment Response #)

Touch Grass Nash (28, 118)
TDEC (55)
State Coal Associations – Illinois, Kentucky, West Virginia (7)
Trisha - (118)
Abel, Sandra - Sierra Club (28, 63, 80)
Abrams, Michael - Clean Up TVA Coalition (12, 31, 71, 105)
Acosta, Heather - Sierra Club (28, 63, 80)
Acron, Anne - Sierra Club (28, 63, 80)
Alexander, Janice - Sierra Club (28, 63, 80)
Alexander, Lea - Sierra Club (28, 63, 80)
Alexander, Suzanne - Sierra Club (28, 63, 80)
Allan, Charlotte - (118)
Allen, Danyelle - Sierra Club (28, 63, 80)
Allmendinger, Gene - Sierra Club (28, 63, 80)
Anderson, Anne - Appalachian Voices (71-77, 118)
Anderson, Betty - Sierra Club (28, 63, 80)
Anderson, Betty - Clean Up TVA Coalition (12, 31, 71, 105)
Anderson, Erica - Appalachian Voices (103-105, 118)
Anderson, Harry - Sierra Club (28, 63, 80)
Andrew, Mitzi - Sierra Club (28, 63, 80)
Andrews, Geneva - Sierra Club (28, 63, 80)
Andrews, Pamela - Sierra Club (28, 63, 80)
Annie - Clean Up TVA Coalition (12, 31, 71, 105)
Ansley, Fran - Appalachian Voices (103-105, 118)
Antonelli, Karla - Sierra Club (28, 63, 80)
Apple, Alex - - (118)
Arduini, Connie - Sierra Club (28, 63, 80)
Armetta, Nancy - Sierra Club (28, 63, 80)
Armour, Ellen - Sierra Club (28, 63, 80)
Arnett, Brian - Sierra Club (28, 63, 80)
Arnold, Mike - Sierra Club (28, 63, 80)
Askew, Bill - Sierra Club (28, 63, 80)
Atkins, John - Clean Up TVA Coalition (12, 31, 71, 105, 118)
Ayers, Darcy - Appalachian Voices (103-105, 118)
Ayers, Ginny - Sierra Club, Appalachian Voices (28, 63, 80)
B., Lily - - (118)
Bahlinger, Cliff - Sierra Club (28, 63, 80)
Bahr, Deborah - Sierra Club (28, 63, 80)
Bailey, Carrie - Sierra Club (28, 63, 80)
Bailey, Elizabeth - - (118)
Bailey, Tonda - Clean Up TVA Coalition (12, 31, 71, 105)
Banbury, Scott M. M. - Sierra Club (28, 63, 80)
Barber, Noelle - Sierra Club (28, 63, 80)
Barger, Elizabeth - Appalachian Voices (103-105, 118)
Barnett, Katherine - Sierra Club (28, 63, 80)
Barrie, Jeffrey - - (118)
Barrientos, Ashley - - (118)
Barrigar, Nancy - - (118)
Barrios, Carla - Sierra Club (28, 63, 80)
Bartelt, Erik - - (118)
Bates, Bob - Sierra Club, Appalachian Voices (28, 63, 80)
Batten, Dave - Sierra Club (28, 63, 80)
Baysinger, Curtis - - (11, 118)
Bazenet, Carol - Sierra Club (28, 63, 80)
Behn, Aftyn - Clean Up TVA Coalition (12, 31, 71, 105)
Bell, Nancy - - (118)
Bensen, Tiffany - Sierra Club (28, 63, 80)
Benson, Sandy - Sierra Club (28, 63, 80)
Berarducci, Timothy - Sierra Club (28, 63, 80)
Berg, Chris - Clean Up TVA Coalition (12, 31, 71, 105)
Bergia, Berta - Sierra Club (28, 63, 80)
Bernard, Cynthia - Sierra Club (28, 63, 80)
Bernard, Michael - Clean Up TVA Coalition (12, 31, 71, 105)

Berry, Jeanette - - Citizens Climate Lobby (71)
Beyer, Rosana - Sierra Club (28, 63, 80)
Bifano, Jenny - Sierra Club (28, 63, 80)
Biggs, Mary - Sierra Club (28, 63, 80)
Black, Stephen - - (118)
Blackburn, Ronald - Sierra Club (28, 63, 80)
Blackman, Laura - - (118)
Blackmon, Brian - - (118)
Blair, Anna - Sierra Club (28, 63, 80)
Blake, Max - Sierra Club (28, 63, 80)
blalock, kathleen - - (118)
Blanco, Karen - Sierra Club (28, 63, 80)
Blane, DIanne - Sierra Club (28, 63, 80)
Blanton, Gwendolyn - - (118)
Blazer, Mark - Sierra Club (28, 63, 80)
Bledsoe, Julie - Appalachian Voices (103-105, 118)
Bledsoe, Ron - - (118)
Bolton, Claudia - Sierra Club (28, 63, 80)
Bomstein, Caroline - Sierra Club (28, 63, 80)
Bond, Leslie - Sierra Club (28, 63, 80)
Boone, Bettye - Sierra Club (28, 63, 80)
Bordenkircher, David - Sierra Club (28, 63, 80)
Bouknight, Jennifer - Sierra Club (28, 63, 80)
Bowers, Bettina - Sierra Club (28, 63, 80)
Bowers, Gary - Sierra Club (28, 63, 80)
Bowman, Charles - - (118)
Bowman, Matthew - Sierra Club (28, 63, 80)
Boyd, Ernest - Appalachian Voices (103-105, 118)
Boyette, Randy - Sierra Club (28, 63, 80)
Braithwaite, Tamara - Sierra Club (28, 63, 80)
Bramlette, Jenny - Sierra Club (28, 63, 80)
Branum, James - - TIPL (118)
Brasfield, Nathan - - (118)
Brawner, Deborah - Clean Up TVA Coalition (12, 31, 71, 105)
Brazil, Alex - - (118)
Breeden, Garland - Appalachian Voices (103-105, 118)
Brendle, David - Appalachian Voices (103-105, 118)
Brennan, Margot - Clean Up TVA Coalition (12, 31, 71, 105)
Brett, Joe - Sierra Club (28, 63, 80)
Brewer, Monica - Sierra Club (28, 63, 80)
Brian, Donna - Sierra Club (28, 63, 80)
Bridges, Mary - - (118)
Bristow, Mary - Sierra Club (28, 63, 80)
Brock, David - - (117)
Brookman, Tonia - Sierra Club (28, 63, 80)
Brooks Taylor, Margaret - Sierra Club (28, 63, 80)
Brown, George - Sierra Club (28, 63, 80)
Brown, Jerry - Sierra Club (28, 63, 80)
Brown, Karla - Sierra Club (28, 63, 80)
Brown, Martin - - (118)
Brown, Ramsay - - (118)
Brown, Ronda - Sierra Club (28, 63, 80)
Brown, Sara - - (118)
Bruckner, Elizabeth - Sierra Club (28, 63, 80)
Bryan, Shelly - Sierra Club (28, 63, 80)
Bryant, Julie - Appalachian Voices (103-105, 118)
Bryant, Shirley - Sierra Club (28, 63, 80)
Buchi-Fotre, Russanne - - (118)
Buckley, Helen - Sierra Club (28, 63, 80)
Buckner, Mary - - (118)
Bulmer, Gary - Clean Up TVA Coalition (12, 31, 71, 105)
Burazer, George - Appalachian Voices (103-105, 118)
Burch, Peggy - Sierra Club (28, 63, 80)
Burgess, Gareth - Sierra Club (28, 63, 80)
Burghardt, Gordon - Clean Up TVA Coalition (12, 31, 71, 105)
Burgin, Edward - Sierra Club (28, 63, 80)
Burgin, John - - (118)
Burks, Neely - Sierra Club (28, 63, 80)
Burns, Thomas - Clean Up TVA Coalition (12, 31, 71, 105)
Burr, Gene - Sierra Club (28, 63, 80)

Burtis, Lisa - Sierra Club (28, 63, 80)
Burton, Barbara - Clean Up TVA Coalition (12, 31, 71, 105)
Burton, Lisa - Sierra Club (28, 63, 80)
Butzu, David - - (118)
Callahan, Michele - Appalachian Voices (103-105, 118)
Campbell, Adam - Sierra Club (28, 63, 80)
Campbell, Gay - Sierra Club (28, 63, 80)
Campbell, Mary - Sierra Club (28, 63, 80)
Campbell, Nathan - Sierra Club (28, 63, 80)
Campbell, Pat - - (118)
Cantu, Joel - Clean Up TVA Coalition (12, 31, 71, 105)
Caraway, Morgan - Sierra Club (28, 63, 80)
Carlson, Doug - Sierra Club (28, 63, 80)
Carlson, Doug - Clean Up TVA Coalition (12, 31, 71, 105)
Carlson-Bancroft, Sally - - (118)
Carlton, Cynthia - Sierra Club (28, 63, 80)
Carpenter, Jamie - Sierra Club (28, 63, 80)
Carpenter, Jennifer - Sierra Club (28, 63, 80)
Carrasco, Diego - - (118)
Carroll, David - - (118)
Carstens, Kandy - Sierra Club (28, 63, 80)
Cathcart, Emily - Sierra Club (28, 63, 80)
Caudill, Elizabeth - Sierra Club (28, 63, 80)
Caya, Patricia - Sierra Club (28, 63, 80)
Cespedes, Christine - Sierra Club (28, 63, 80)
Chapdelaine, Perry - Sierra Club (28, 63, 80)
Charbonnet, Karen - Sierra Club (28, 63, 80)
Cheadle, Chad - Sierra Club (28, 63, 80)
Childress, Regina - - (118)
Clark, Kenneth - Sierra Club (28, 63, 80)
Clarke, Jerry - - None (118)
Claybaker, Pamela - Sierra Club (28, 63, 80)
Cleveland, Gladys - Sierra Club (28, 63, 80)
Cloud, Barbara - - (118)
Coe, Delores - Clean Up TVA Coalition (12, 31, 71, 105)
Coe, Pam - Sierra Club (28, 63, 80)
Coggins, Nathan - Sierra Club (28, 63, 80)
Cohen, Charles - Clean Up TVA Coalition (12, 31, 71, 105)
Cole, Kevin - Sierra Club (28, 63, 80)
Coles, Nathan - Sierra Club (28, 63, 80)
Coltman, Evelyn - Clean Up TVA Coalition (12, 31, 71, 105)
Conley, Cathy - Sierra Club (28, 63, 80)
Conley, Patrick - Sierra Club (28, 63, 80)
Cook-Casey, Vickie - Sierra Club (28, 63, 80)
Coombs, Joyce - Sierra Club (28, 63, 80)
Cooper, John - - Metropolitan Government of Nashville-Davidson County (15, 19, 118)
Coopwood, Phyllis - Sierra Club (28, 63, 80)
Corlew, Larina - Appalachian Voices (103-105, 118)
Cornelius, Margaret - Sierra Club (28, 63, 80)
Cosby, Christopher - - (118)
Cover, Ann - Sierra Club (28, 63, 80)
Cowan, Margaret - Sierra Club (28, 63, 80)
Cox, Annis - - (118)
Coyle, Maggie - Sierra Club (28, 63, 80)
Craddock, Tracy - Sierra Club (28, 63, 80)
Crawford, Jane - Sierra Club (28, 63, 80)
Crawford, Katherine - Sierra Club (28, 63, 80)
Crawford, Valerie - Sierra Club (28, 63, 80)
Crockett, David - - TIPL (118)
Cross, Jimmy - Sierra Club (28, 63, 80)
Crossnan, Linda - Sierra Club (28, 63, 80)
Crow, Charles & Dinah - Sierra Club (28, 63, 80)
Cummings, Rebecca - Sierra Club (28, 63, 80)
Cupp, Penny - Sierra Club (28, 63, 80)
Currie, Steven - - (118)
Curry, Wyatt - - (118)
Curtis, Anthony - - (118)
Cutler, Gayla - Sierra Club (28, 63, 80)
Czachurski, John - Sierra Club (28, 63, 80)

Dacus, Chris - Sierra Club (28, 63, 80)
Dacus, Chris - Clean Up TVA Coalition (12, 31, 71, 105)
Dalton, Hunter - Sierra Club (28, 63, 80)
Daniels, Charlotte - Sierra Club (28, 63, 80)
Daugherty, Ella - - (118)
Davidson, Bryan - - TDEC (55)
Davidson, David - Sierra Club (28, 63, 80)
Davidson, Dee - Clean Up TVA Coalition (12, 31, 71, 105)
Davis, Brent - Sierra Club (28, 63, 80)
Davis, Joanna - Sierra Club (28, 63, 80)
Davis, Marge - Sierra Club (28, 63, 80)
Davis, Thomasina - Appalachian Voices (103-105, 118)
Day, Bruce - Sierra Club (28, 63, 80)
de Haven, Helen - Clean Up TVA Coalition (12, 31, 71, 105)
Deakins, Casey - - (118)
Dean, Caroline - Sierra Club (28, 63, 80)
DeGeorge, Gail - Sierra Club (28, 63, 80)
Denison, Diane - - (118)
Dennison, Laura - - (118)
Denslow, Sarah - Sierra Club (28, 63, 80)
Densmore, Gregory - Sierra Club (28, 63, 80)
DeWitt, Sue - Sierra Club (28, 63, 80)
Diekman, Jessica - Sierra Club (28, 63, 80)
Diekman, Josh - Sierra Club (28, 63, 80)
Dillard Sr, James Edward - - None (117)
Dirmeyer, Deborah - Appalachian Voices (103-105, 118)
Dishman, Patricia - Sierra Club (28, 63, 80)
Dodd, Douglas - Sierra Club (28, 63, 80)
Dodd, Will - - (118)
Doherty, Brian - Sierra Club (28, 63, 80)
Dolan, Debby - Appalachian Voices (103-105, 118)
Dooley, Gerald - Sierra Club (28, 63, 80)
Dorais, Mark - Sierra Club (28, 63, 80)
Dornan, Sam - Sierra Club (28, 63, 80)
Dornfield, Robert & Sandra - Sierra Club (28, 63, 80)
Dorsey, Judy - Sierra Club (28, 63, 80)
Doss, Eddie - - (118)
Dotson, Ashley - Sierra Club (28, 63, 80)
Doughty, Susan - Sierra Club (28, 63, 80)
Dowdell, Irene - Sierra Club (28, 63, 80)
Draper, Karen - Sierra Club (28, 63, 80)
Drew, Craig - Sierra Club (28, 63, 80)
Drones, Monica - Appalachian Voices (103-105, 118)
Drumright, Chris - Sierra Club (28, 63, 80)
Dubrick, Michael - Sierra Club (28, 63, 80)
Duncan, James - Sierra Club (28, 63, 80)
Dunn, Laura - Sierra Club (28, 63, 80)
Dunson, Debra - Clean Up TVA Coalition (12, 31, 71, 105)
Durman, Candice - Clean Up TVA Coalition (12, 31, 71, 105)
Dye, Dana - Appalachian Voices (103-105, 118)
Eakins, Jessica - Sierra Club (28, 63, 80)
Echevarria, Mari Lana Teska - Sierra Club (28, 63, 80)
Edgeworth, Andrew - Sierra Club (28, 63, 80)
Edwards, Jacqueline - Sierra Club (28, 63, 80)
Edwards, Laura - Sierra Club (28, 63, 80)
Egan, Lynn - - (118)
Elliot, Debbie - - Email (111. 112, 117)
Elliot, Jason - Sierra Club (28, 63, 80)
Elliott, Joan - - (118)
Elrod-Erickson, Morgan - - (118)
Emmons, Jeanette - Sierra Club (28, 63, 80)
Empey, Jill - Sierra Club (28, 63, 80)
England, Scharla - Sierra Club (28, 63, 80)
Ercelawn, Ann - Sierra Club (28, 63, 80)
Ercelawn, Ann - Appalachian Voices (103-105, 118)
Erickson, Connie - Sierra Club (28, 63, 80)
Ericson, Juliana - Sierra Club (28, 63, 80)
Ertelt, Bonnie - - (118)
Eyler, Joyce - - (118)
Faby, Ellen - - (118)

Faccia, John - Sierra Club (28, 63, 80)
Fairbank, Christopher - - None (118)
Fann, Tracy - Sierra Club (28, 63, 80)
Farmer, Myra - Sierra Club (28, 63, 80)
Farro, Nicholas - Sierra Club (28, 63, 80)
Fay, Michael - - (118)
Fedorsin, Martha - Sierra Club (28, 63, 80)
Feile, Diana - Sierra Club (28, 63, 80)
Ferguson, Peter - - (118)
Ferriss, Adrienne - Appalachian Voices (103-105, 118)
Fields, Judy - Sierra Club (28, 63, 80)
Fields, Melissa - - (117)
Filmer, Alexis - - (118)
Firth, Dan - - (118)
Fish, Frank - - (118)
Fitzgerald, Marian - Sierra Club (28, 63, 80)
Fitzpatrick, Sherri - Sierra Club (28, 63, 80)
Flaherty, Kathy - Sierra Club (28, 63, 80)
Fleming, Lydia - Sierra Club (28, 63, 80)
Fleming, Mya - - (118)
Fletcher, Herman - Sierra Club (28, 63, 80)
Flinn, Michael - Sierra Club (28, 63, 80)
Fonberg, Ignacy - - (118)
Forest, Terra - Sierra Club (28, 63, 80)
Forrest, Terry - Sierra Club (28, 63, 80)
Foust, Reid - Clean Up TVA Coalition (12, 31, 71, 105)
Fox, Geri - Appalachian Voices (103-105, 118)
Foy, Clifton - Clean Up TVA Coalition (12, 31, 71, 105)
Franklin, Doug - - (118)
Franklin, Joe - Appalachian Voices (103-105, 118)
Franklin, L. - Sierra Club (28, 63, 80)
Franklin, Margaret - Sierra Club (28, 63, 80)
Franks, William - Sierra Club (28, 63, 80)
Franks, William - Clean Up TVA Coalition (12, 31, 71, 105)
Fred, Sheena - - (118)
Freeman, Ann - Sierra Club (28, 63, 80)
Frey, Adrienne - Sierra Club, Appalachian Voices, Clean Up TVA Coalition (12, 28, 31, 63, 71, 80, 105)
Friederichsen, Jacqueline - Sierra Club (28, 63, 80)
Fuller, Leslie - Sierra Club (28, 63, 80)
Furtney, Mary - Sierra Club (28, 63, 80)
Gaines, Cherie - Sierra Club (28, 63, 80)
Galben, Denise - Sierra Club, Clean Up TVA Coalition (12, 28, 31, 63, 71, 80, 105)
Galil, Leonie - Sierra Club (28, 63, 80)
Galloway, Robert - Sierra Club (28, 63, 80)
Gamache, Brenda - Clean Up TVA Coalition (12, 31, 71, 105)
Garber, Elizabeth - Sierra Club (28, 63, 80)
Garcia, Anne - - (118)
Garcia, Christine - Sierra Club (28, 63, 80)
Garcia, Kathy - Clean Up TVA Coalition (12, 31, 71, 105)
Gargano, Breaux - - (118)
Garrett, David - Sierra Club (28, 63, 80)
Garrett, Robert - Sierra Club (28, 63, 80)
Gaumer, Derek - Sierra Club (28, 63, 80)
Geltman, Helen - Sierra Club (28, 63, 80)
Gerdeman, Martha - Appalachian Voices (103-105, 118)
Ghantasala, Sudeep - Clean Up TVA Coalition (12, 31, 71, 105)
Gibson, Gordon - Sierra Club (28, 63, 80)
Gibson, Judith - Sierra Club (28, 63, 80)
Gilbert, Mike - - TDOT (116)
Gilbert, Richard - Sierra Club (28, 63, 80)
Gilbert, William - Appalachian Voices (103-105, 118)
Givens, Roger - Sierra Club (28, 63, 80)
Glass, Michelle - Sierra Club (28, 63, 80)
Glassford, Bertha - Sierra Club (28, 63, 80)
Glenn, Patricia - Sierra Club (28, 63, 80)
Goddard, Carolyne - Appalachian Voices (103-105, 118)
Golden, Joanne - Sierra Club (28, 63, 80)
Gonyea, Gerald - Sierra Club, Clean Up TVA Coalition (12, 28, 31, 63, 71, 80, 105)

Gonzales, Catherine - Sierra Club (28, 63, 80)
Goodkind, Mary - Clean Up TVA Coalition (12, 31, 71, 105)
Goodman, Jamie - Appalachian Voices (103-105, 118)
Gordon, Pamela - Sierra Club (28, 63, 80)
Gore, Jesse - Clean Up TVA Coalition (12, 31, 71, 105)
Gould, Debra - Sierra Club (28, 63, 80)
Govette, Lyn - Appalachian Voices (103-105, 118)
Goyret, Samantha - - (118)
Grabeel, Kelsey - Sierra Club (28, 63, 80)
Grady, Sally - - (118)
Grandstaff, Cynthia - Sierra Club (28, 63, 80)
Graves, Emily - Sierra Club (28, 63, 80)
Grayson, Allen - Clean Up TVA Coalition (12, 31, 71, 105)
Green, Elizabeth - Sierra Club (28, 63, 80)
Greene, Sharon - Sierra Club (28, 63, 80)
Gregg, Woodfin - Sierra Club (28, 63, 80)
Gregory, Beverly - Sierra Club (28, 63, 80)
Gress, Jack - Sierra Club (28, 63, 80)
Griffith, Bruce - Sierra Club (28, 63, 80)
Griffith, Tina - - (118)
Griffith, Yvonne - Sierra Club, Appalachian Voices (28, 63, 80)
Gross, Robert - Sierra Club (28, 63, 80)
Grover, Kathleen - Sierra Club (28, 63, 80)
Groves, Matthew - - TIPL (118)
Groves, Sue - - (118)
Gundrum, Judith - Sierra Club (28, 63, 80)
Gupta, Shalini - - (118)
Gurecki, Donna - Clean Up TVA Coalition (12, 31, 71, 105)
Guthrie, Linda - Clean Up TVA Coalition (12, 31, 71, 105)
Guyton, Pauline - Sierra Club (28, 63, 80)
Gvozdas, Felicia - Sierra Club (28, 63, 80)
H, Tiffany - Sierra Club (28, 63, 80)
Hacker, Tim - Sierra Club (28, 63, 80)
Haggard, Cherrie - Sierra Club (28, 63, 80)
Haizlip, Wilson & Suzanne - Sierra Club (28, 63, 80)
Hall, Alan - Sierra Club (28, 63, 80)
Hall, Ashlyn - Sierra Club (28, 63, 80)
Hall, Casey - - (118)
Hall, Jennifer - Sierra Club (28, 63, 80)
Hall, R - Sierra Club (28, 63, 80)
Hallgreen, Brian - - (118)
Hallmark, Debbie - Sierra Club (28, 63, 80)
Halperin, Rebecca - Sierra Club (28, 63, 80)
Hamilton, Chuck - Clean Up TVA Coalition (12, 31, 71, 105)
Hamilton, Elizabeth - Sierra Club (28, 63, 80)
Hammer, Rosamond - Sierra Club (28, 63, 80)
Hanna, Christy - Sierra Club (28, 63, 80)
Hansen, Anne - Sierra Club (28, 63, 80)
Hansen, Neil - Sierra Club (28, 63, 80)
Hansen, Teresa - - (118)
Harbin, Susan - Sierra Club (28, 63, 80)
Hardin, Anne - - (118)
Hardwick, Lynn - Clean Up TVA Coalition (12, 31, 71, 105)
Harkey, John - Sierra Club (28, 63, 80)
Harness, Sandy - Sierra Club (28, 63, 80)
Harris, Angelia - Sierra Club (28, 63, 80)
Harris, Karl - Sierra Club (28, 63, 80)
Harris, Melissa - Sierra Club (28, 63, 80)
Harris, Ron - Appalachian Voices (103-105, 118)
Harrison, Cole & Angie - - None (117)
Hart, Michelle - - (117)
Harvey, Jessica - Sierra Club (28, 63, 80)
Hathcock, Susan - Clean Up TVA Coalition (12, 31, 71, 105)
Havens, Susan - - (118)
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Henderson, Jenna - Sierra Club (28, 63, 80)
Heniff, Kathryn - Clean Up TVA Coalition (12, 31, 71, 105)
Henley, Gail - Sierra Club (28, 63, 80)
Hennessey, Hannah - - (118)

Henson, Jeffrey - Clean Up TVA Coalition (12, 31, 71, 105)
Heppel, Catch - Sierra Club (28, 63, 80)
Herron, Jane - Sierra Club (28, 63, 80)
Herzig, Katie - Sierra Club (28, 63, 80)
Hice, Larry - Sierra Club (28, 63, 80)
Hill, Ann - Sierra Club (28, 63, 80)
Hill, Anne - Sierra Club (28, 63, 80)
Hillis, Lisa - - (118)
Hinders, Logan - - (118)
Hintz, Cindy - Sierra Club (28, 63, 80)
Hoban, Kevin - Sierra Club (28, 63, 80)
Hodges, Diantha - Sierra Club (28, 63, 80)
Hoke, Thomas - Sierra Club (28, 63, 80)
Holder, Carla - Sierra Club (28, 63, 80)
Holliday, Stacey - Sierra Club (28, 63, 80)
Hollingsworth, Shelby - Sierra Club (28, 63, 80)
Holt, David - Appalachian Voices (103-105, 118)
Holton, Elizabeth - Sierra Club (28, 63, 80)
Hood, Shelby L. - Sierra Club (28, 63, 80)
Hope, Julia - Sierra Club (28, 63, 80)
Hoskins, Christopher - Sierra Club (28, 63, 80)
Hough, Gil - - (118)
Houston, Sarah - Sierra Club (28, 63, 80)
Howard, Lynda - Sierra Club (28, 63, 80)
Hoy, Cliff - Sierra Club (28, 63, 80)
Huang, Anthony - - (118)
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Humphrey, Pamela - Sierra Club (28, 63, 80)
Hungate, Elizabeth - Sierra Club (28, 63, 80)
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Hunt, Sarah - Sierra Club (28, 63, 80)
Hunter, Sonja - Sierra Club (28, 63, 80)
Huskinson, Lynne - Appalachian Voices (103-105, 118)
Huss, Phil - Sierra Club (28, 63, 80)
Hyche, Kenneth - Sierra Club (28, 63, 80)
Hyman, Lynn - Sierra Club (28, 63, 80)
Ibbetson, Marie - Appalachian Voices (103-105, 118)
Ilgner, Jane - Sierra Club (28, 63, 80)
Inness, Linda - Sierra Club (28, 63, 80)
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Irwin, Michael - Sierra Club (28, 63, 80)
Jackson, Kennedy - - (118)
Jackson, Mary - - (118)
Jackson, Ruth - Sierra Club (28, 63, 80)
Jacob, Kathleen - - (118)
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James, Marcus - Sierra Club (28, 63, 80)
Jannetta, Susan - Sierra Club (28, 63, 80)
Jardine, Elise - Sierra Club (28, 63, 80)
Jarvis, Kristina - Sierra Club (28, 63, 80)
Jasud, Lawrence - Sierra Club (28, 63, 80)
Jobe, Kenneth - Sierra Club (28, 63, 80)
Jobe, Kenneth - Clean Up TVA Coalition (12, 31, 71, 105)
Jobe, Kenneth - - (118)
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Johnson, Greg - Sierra Club (28, 63, 80)
Johnson, Greg - - (118)
Johnson, Heather - Sierra Club (28, 63, 80)
Johnson, James - Sierra Club (28, 63, 80)
Johnson, Joy - Appalachian Voices (103-105, 118)
Johnson, Margaret - Sierra Club (28, 63, 80)
Johnson, Savannah - Sierra Club (28, 63, 80)
Johnston, Jean - Sierra Club (28, 63, 80)
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Jones, Leslie - - (118)
Jones, Timothy - - (118)
Kai Mahoney, Kristin - Sierra Club (28, 63, 80)
Kaller, Frances - Sierra Club (28, 63, 80)

Kaplan, Ira - - (118)
Kaufman, Debra - Sierra Club (28, 63, 80)
Keeler, Rebecca - - (118)
Keeney, Diane - Sierra Club (28, 63, 80)
Kelly, Amy - Sierra Club (28, 63, 80)
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Kelly, Laura - Sierra Club (28, 63, 80)
Kelly, Lori - - (118)
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Kennard, Kimberly - Sierra Club (28, 63, 80)
Keown, Jake - - (118)
Kevra, Susan - - (118)
Key, Solara - Sierra Club (28, 63, 80)
Keyser, Donald - Sierra Club (28, 63, 80)
Khanna, Nidhi - Sierra Club (28, 63, 80)
Kimbrell, Bonita - Sierra Club (28, 63, 80)
Kindig, Ted - - (118)
Kinney, Wanda - Sierra Club (28, 63, 80)
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Kirk, Rachel - Sierra Club (28, 63, 80)
Kiselev, Roman - Sierra Club (28, 63, 80)
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Klugiewicz, Mark - Sierra Club (28, 63, 80)
Kmeyer, Kerry - - (117)
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Knight, Vernon - - (118)
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Krishnan, Meera - Sierra Club (28, 63, 80)
Kromer, Rachel - Sierra Club (28, 63, 80)
Kuhnle, Mari - Sierra Club (28, 63, 80)
Kurtz, Sandra - Clean Up TVA Coalition (12, 31, 71, 105)
Kurtz, Sheila - Sierra Club (28, 63, 80)
Kuykendall, Judith - Sierra Club (28, 63, 80)
Kyne, Kyle - - (118)
Kyne, Tim - - (118)
Lamberts, Francis - - (118)
Lamons, Kristina - Sierra Club (28, 63, 80)
Lampe, Raymond - Clean Up TVA Coalition (12, 31, 71, 105)
Lancaster, Chris - - (118)
Land, Jeffrey - Sierra Club (28, 63, 80)
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Lane, Roe - - (117)
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Lasater, Mary - Sierra Club (28, 63, 80)
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Laws, Forrest - Sierra Club (28, 63, 80)
Lea, Clara - Sierra Club (28, 63, 80)
Learch, Lynn - Sierra Club (28, 63, 80)
LeFebvre, Peter - - (118)
Leftenant, Nathan - Clean Up TVA Coalition (12, 31, 71, 105)
Legan, Mary - - (118)
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Lemaire, Joceline - - (118)
Lemire, Mary - Sierra Club (28, 63, 80)
Lentz, Amanda - Sierra Club (28, 63, 80)
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LePetri, Anna - - (118)
Lesiserson, Alan - - (118)

Leslie, Renee - - (118)
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Lewis, Albert - Sierra Club (28, 63, 80)
Lewis, Jan - Sierra Club (28, 63, 80)
Lewis, Jeff - Sierra Club (28, 63, 80)
Lewis, Magdalena - Clean Up TVA Coalition (12, 31, 71, 105)
Lichtenstein, Gabrielle - Appalachian Voices (103-105, 118)
Lindner, Steven - - (118)
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Lindsey, Melissa - Sierra Club (28, 63, 80)
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Linn, Mary Louise - Sierra Club (28, 63, 80)
Lipe, Robert - Sierra Club (28, 63, 80)
Lipson, Steven - Sierra Club (28, 63, 80)
LoBato, Denae - Sierra Club (28, 63, 80)
Loflin, Greg - Sierra Club (28, 63, 80)
Longmire, Maggie - Sierra Club (28, 63, 80)
Loveland, Jim - Clean Up TVA Coalition (12, 31, 71, 105)
Loveless, Heather - Sierra Club (28, 63, 80)
Lowe, Reginald - Sierra Club (28, 63, 80)
Lowery, R - Sierra Club (28, 63, 80)
Lundstrom, Lisa - Sierra Club (28, 63, 80)
Lupton, Sylvia - Sierra Club (28, 63, 80)
Lutken, Carol - - (118)
Lutken, Thomas - - (118)
Lutterloh, Amy - Sierra Club (28, 63, 80)
Ly, - - - (118)
Lynch, Laura - Sierra Club (28, 63, 80)
Lyons, Janice - - (118)
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MacDonnell, Christine - Sierra Club (28, 63, 80)
Mace, Charles - Sierra Club (28, 63, 80)
Mackey, Carol - Sierra Club (28, 63, 80)
Mackey, Gerald - Sierra Club (28, 63, 80)
MacLaren, Shelley - Sierra Club (28, 63, 80)
Macri, Brandt - Sierra Club (28, 63, 80)
Magness, Patricia - - (118)
Maher, Peggy - Sierra Club (28, 63, 80)
Malone, Taylor - Sierra Club (28, 63, 80)
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Manis, Libby - Appalachian Voices (103-105, 118)
Mann, Louise - Sierra Club (28, 63, 80)
Manning, Russ - - (118)
Manzione, Lynn - Clean Up TVA Coalition (12, 31, 71, 105)
Marcom-Gatlin, Cherie - Sierra Club (28, 63, 80)
Marsh, Daniel - - (118)
Marshall, Reginald - - (118)
Marshall, Trish.uk - - (118)
Marshall, Willola - Sierra Club (28, 63, 80)
Martinez, Cherie - Sierra Club, Clean Up TVA Coalition (12, 28, 31, 63, 71, 80, 105)
Martinez, Lorraine - - (118)
Martinez, Nate - - (118)
Mashburn, Taya - Sierra Club (28, 63, 80)
Matsen Cantrell, Anna - Sierra Club (28, 63, 80)
Matthews, Max - - (118)
Mauzy, Joshua - - (118)
Mavournin, Kathleen - Appalachian Voices (103-105, 118)
May, Elizabeth - Sierra Club (28, 63, 80)
May, Maureen - Sierra Club (28, 63, 80)
Mayer, Jane - Sierra Club (28, 63, 80)
McCabe, William - Appalachian Voices (103-105, 118)
McCachren, Elizabeth - - TIPL (69, 104, 118)
McCathren, Holly - - (118)
McCathren, Randall - (118)
Mcclenahan, Kimberly - (118)
Mccormick-Awad, Cassie - Sierra Club (28, 63, 80)
McCue, Anne - Sierra Club (28, 63, 80)

McCune, Lisa - Sierra Club (28, 63, 80)
McCurdy, Anna - Sierra Club (28, 63, 80)
Mcdaniel, Jodi - Sierra Club (28, 63, 80)
McDowell, Sandra - Clean Up TVA Coalition (12, 31, 71, 105)
McGee, G. Sanford - (118)
McGlocklin, Lecil - Clean Up TVA Coalition (12, 31, 71, 105)
McGrath, William - Sierra Club (28, 63, 80)
McIlmoil, Rory - Appalachian Voices (103-105, 118)
McInnes, Sheila - Sierra Club (28, 63, 80)
McIntosh, JoAnn - Clean Up TVA Coalition, Sierra Club (12, 28, 31, 63, 71, 80, 105)
McIntyre, Karen - (118)
McLain, Beth - Sierra Club (28, 63, 80)
McMahan, Linda - Sierra Club (28, 63, 80)
Mcwilliams, Cynthia - Sierra Club (28, 63, 80)
Medford, Marcia - (118)
Medlin, Barry - Sierra Club (28, 63, 80)
Medyukhina, Anna - Sierra Club (28, 63, 80)
Megill, Carrie - Sierra Club (28, 63, 80)
Melton, K - Sierra Club (28, 63, 80)
Midler, Evan - State Coal Associations – Illinois, Kentucky, West Virginia (7)
Mietus, Norbert - Clean Up TVA Coalition (12, 31, 71, 105)
Migliara, Barbara - Sierra Club (28, 63, 80)
Miller, Adam - (118)
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Miller, Jena - Sierra Club (28, 63, 80)
Miller, Mike - Sierra Club (28, 63, 80)
Miller, Nichole - Sierra Club (28, 63, 80)
Mills, Adam - Clean Up TVA Coalition (12, 31, 71, 105)
Minault, Kent - Appalachian Voices, Clean Up TVA Coalition, Sierra Club (103-105, 118)
Minnehan, John - Sierra Club (28, 63, 80)
Mirramezani, Matin - Sierra Club (28, 63, 80)
Moats, Shelley - Sierra Club (28, 63, 80)
Mohning, Kathleen - Sierra Club (28, 63, 80)
Molloy, Janice - Sierra Club (28, 63, 80)
Montgomery, Brandon - (117)
Montgomery, Carol - Clean Up TVA Coalition (12, 31, 71, 105)
Moone, Bill - (118)
Moore, Angela - Sierra Club (28, 63, 80)
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Appendix P – Responses to EPA Cooperating Agency Comments

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

June 30, 2022

Ms. Ashley Pilakowski
NEPA Specialist
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902

Re: EPA Comments on the Draft Environmental Impact Statement for the Cumberland Fossil Plant Retirement, Stewart County, Tennessee; CEQ No: 20220059

Dear Ms. Pilakowski:

The U.S. Environmental Protection Agency reviewed the referenced document in accordance with Section 309 of the Clean Air Act (CAA) and Section 102(2)(C) of the National Environmental Policy Act (NEPA). The CAA Section 309 role is unique to EPA. Among other things, CAA Section 309 requires EPA to review and comment publicly on any proposed federal action subject to NEPA's environmental impact statement requirement.

The Tennessee Valley Authority issued a Draft Environmental Impact Statement (DEIS) to evaluate the impacts of the proposed retirement and demolition of two units of the Cumberland Fossil Plant (CUF) and the addition of replacement generation to recover the generation capacity lost from the retirement of one unit. The CUF is situated on a 2,388-acre reservation of the Cumberland River at its confluence with Wells Creek in Stewart County, Tennessee (TN). The two-unit, coal-fired steam-generating plant is the largest plant in the TVA coal fleet, with a summer net generating capacity of 2,470-megawatts (MW). According to the DEIS, the proposed action would retire the CUF plant and pursue an alternative power generation source to provide cost-effective replacement generation and would be consistent with TVA's 2019 Integrated Resource Plan (IRP) and near-term energy production goals.

TVA developed and analyzed in detail the proposed action, the no-action alternative, and two additional alternatives. TVA considered five additional resource alternatives, as well as alternative fuels, but eliminated them from further discussion. Under the No-Action Alternative, TVA would continue to maintain and operate coal fired boilers at CUF. TVA's other alternatives include:

- **Alternative A:** Retirement and demolition of CUF and construction and operation of a 1,450 MW capacity combined cycle combustion turbine (CC) natural gas plant at the same site, including a 32-mile natural gas pipeline extending through Stewart, Houston, and Dickson Counties, TN.
- **Alternative B:** Retirement and demolition of CUF and construction and operation of natural gas simple cycle combustion turbines (CT) at two alternate locations.
- **Alternative C:** Retirement and demolition of CUF and construction and operation of solar generation and energy storage facilities, at alternate locations primarily in middle Tennessee.

In the DEIS, TVA identifies Alternative A as the preferred alternative based on alignment with TVA's 2019 IRP plan; meeting engineering needs to retire the existing CUF plant; and, facilitating TVA's long-term plans to integrate renewable and distributed generation resources into its system. According to the DEIS, Alternative A provides baseload power as renewable sources are deployed.

Based on our review of the DEIS and described in our detailed comments, the EPA has developed recommendations for TVA that would reduce the environmental impacts of the proposed action and improve the EIS analysis by: 1) considering practicable mitigation to reduce greenhouse gas (GHG) emissions, 2) conducting a more robust alternatives analysis, and 3) addressing deficiencies in the disclosure of GHG emissions and their impacts. The recommendations focus on essential information that TVA needs to disclose and consider to fulfill its basic NEPA duty to take a "hard look" at the environmental impacts of the proposed action and reasonable alternatives, both for public awareness and to ensure its decision making is fully informed.[1]

The EPA is concerned that the analysis of the preferred alternative did not consider important, available mitigation options to reduce impacts from GHG emissions. The EPA recommends that the EIS discuss in detail options for significantly mitigating the environmental impacts of the proposed action, such as co-firing with and eventually moving to 100% clean hydrogen or installation of carbon capture equipment at the proposed power plant.[2] In its enclosed detailed comments, the EPA has provided a table of current examples being implemented. Incorporating mitigation would not only show leadership in line with the federal policy priority to reduce climate risks, but also reduce regulatory risks for TVA ratepayers.

The EPA also finds that the DEIS does not fully disclose modeling and underlying assumptions for the alternatives considered, nor those alternatives that were considered and eliminated from further discussion. The EPA recommends TVA transparently disclose its modeling methodologies and assumptions to better enable a comparison between the alternatives. Further, the EPA recommends that TVA identify and discuss in detail an alternative reflecting a hybrid approach—for example, combining a smaller natural gas plant with a portfolio of non-gas resources, including energy efficiency and demand management, renewable energy, energy storage, and other distributed energy resources. Such an alternative, or other alternatives, would better align with decarbonization pathways necessary to meet science-based targets for GHG reductions to avoid the worst impacts of climate change.[3]

In addition, the EPA identified that the DEIS does not fully quantify or adequately disclose the impacts of the GHG emissions from the proposed action and alternatives. The EPA recommends TVA include

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[1] See, e.g., *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332 (1989) (NEPA's policy goals are realized through procedures requiring agencies take a 'hard look' at environmental consequences, citing to *Kleppe v. Sierra Club*, 427 US 390 (1976)).

[2] Two types of hydrogen production are referred to as "clean" hydrogen—blue and green. Blue hydrogen uses the Steam Methane Reformation process with the addition of carbon capture technology. Green hydrogen is an emerging technology that separates hydrogen from water molecules via electrolysis. As long as zero-emissions electricity is the power source, green hydrogen results in no direct emissions and is one of the cleanest forms of production. See Rhodium Group, "Clean Hydrogen: A Versatile Tool for Decarbonization" https://rhg.com/research/clean-hydrogen-decarbonization/

[3] Notably, the conclusions of Synapse Energy Economic Inc. report "Clean Portfolio Replacement at Tennessee Valley Authority: Economic and Emissions Benefits for TVA Customers" contradict the draft EIS conclusions. https://drive.google.com/file/d/1rgB3Apa3C-1PF0CyVMHqdq_t4NX85VCL/view The Synapse report transparently lays out important modeling approaches and cost, emissions and other input data. They also explore hybrid options that offer lower costs and better environmental results. Ideally, the Final EIS (FEIS) will be equally transparent so readers can compare input assumption and modeling results, including results about costs and environmental impacts.

quantified estimates of all indirect GHG emissions from each of the alternatives over their anticipated lifetime, including reasonably foreseeable emissions from the production, processing, and transportation of natural gas. Estimated indirect emissions, as with the direct emissions already estimated in the DEIS, provide essential information to the public and TVA decisionmakers. These emissions and more appropriate disclosure of their social cost are critical to disclosing the total climate impact of each alternative. These impacts include implications for climate justice, given that communities with environmental justice concerns and other underserved populations are disproportionately impacted by climate change.[4]

As discussed in the detailed comments, the EPA identified that Alternative A, the preferred alternative, would result in significant GHG emissions and associated environmental impacts. The EPA believes there are mitigation options and reasonable alternatives that were not analyzed in detail in the DEIS that would reduce GHG emissions. In addition, impacts were not sufficiently disclosed. As discussed in our detailed comments, the EPA strongly recommends the proposed action be modified or a different preferred alternative be selected in the Final EIS, and that the DEIS informational deficiencies be clearly remedied for the public and TVA decisionmakers.

The concerns raised herein are substantial in EPA's view, and we look forward to working collaboratively with TVA in the coming months to share our expertise with the goal of addressing them; as you know, in circumstances where deficiencies in an environmental impact statement prevent meaningful analysis, the remedy is supplementation to ensure adequate disclosure and analysis (please see 40 C.F.R. § 1502.9).

Our detailed comments also include important suggestions for further considering GHG reduction policies, climate resilience, air quality, environmental justice, and water resources issues. The EPA appreciates the opportunity to review the DEIS and looks forward to continued participation with the Cumberland CUF Retirement project. The EPA requests to be a cooperating agency to help address our comments. To discuss our technical recommendations further, please contact Mr. Douglas White of my staff at white.douglas@epa.gov or (404) 562-8586.

Sincerely,

Mark J. Fite
Director
Strategic Programs Office

Enclosure

[4] See, *e.g.*, Climate Change and Social Vulnerability, EPA (2021). https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf

Enclosure

Detailed Technical Comments on the Draft Environmental Impact Statement (DEIS)
for the Cumberland Fossil Plant Retirement
CEQ No: 20220059

I. The EPA recommends TVA conform its EIS to the science-driven policy context.

The EPA believes it is essential for TVA to improve the proposed action and EIS because of the urgency of the climate crisis. Overlooked options for TVA to take meaningful, cost-effective action to reduce GHG emissions can help conform TVA's action to science-driven policy goals. The United States has established a Paris-agreement target to reduce net GHG emissions economy-wide by 50-52% below 2005 levels, consistent with a pathway to net-zero by 2050. Executive Order (EO) 14057 establishes a policy for the federal government to lead by example in order to achieve a carbon-pollution free electricity sector by 2035 and net-zero emissions economy-wide by no later than 2050.[5] These and other policies reflect science-based GHG reduction goals to avoid the worst impacts of climate change. The most recent scientific reports by the Intergovernmental Panel on Climate Change reinforce the urgent need to take climate action. TVA's proposal provides an important opportunity to do so.

The EPA recommends that the Final EIS (FEIS) include a discussion of whether and to what extent the estimated GHG emissions from the proposed alternatives are consistent with achieving science based national GHG reduction targets and any relevant state or local goals. Also, because the proposed action is consistent with the goals of the 2019 Integrated Resource Plan (IRP), TVA's analysis should include a discussion of how the proposed action and 2019 IRP will achieve GHG reduction targets. Additionally, the EPA recommends that the 2019 IRP should be updated to include the actions that TVA will take to align with its 2021 Strategic Intent and Guiding Principles and national science-based goals.

II. TVA should consider regulatory, policy, and energy transition trends that will affect new assets, as well as appropriate mitigations.

A variety of State and Federal regulations are likely to affect the power sector in the coming decades. In general, these regulatory efforts aim to reduce fossil fuel emissions. There are also forecasts of declining costs and increasing adoption of renewable generation as well as increased electricity demand from increased electrification. The EPA recommends thorough consideration of these trends, transitions, and risks in planning any large-scale power sector project.

Renewable energy technologies, such as wind and solar, are currently cost-competitive despite minimal subsidies and offer future opportunities for cost savings compared to coal and natural gas electric generating units (EGUs). The U.S. Energy Information Administration (EIA) projects inflation-adjusted US coal prices to remain at current levels over the next three decades, while natural gas prices are expected to slightly fall.[6] Coal and natural gas combustion are relatively mature technologies that have limited potential for further cost-saving innovations. Renewable energy may retain greater potential for

[5] Executive Order on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability/

[6] Total Energy: Production: Crude Oil and Lease Condensates, U.S. Energy Information Administration - EIA - Independent Statistics and Analysis

further cost reductions via innovation and learning-by-doing.[7] Similar remaining opportunities for further cost reductions in coal and natural gas technologies may be comparatively rare and expensive to exploit.

Multi-decade time horizons associated with new or refurbished fossil fuel EGUs present financial risks to TVA and its ratepayers. Many coal plants are already uneconomic. Natural gas plants could become similarly pressured in the face of stiff competition from renewable sources with lower climate risk and cost-reduction potential.[8] Many natural gas EGUs are over 30 years old with the capacity-weighted age of the current US natural gas fleet around 22 years.[9] Numerous coal-fired power plants have operated continuously for even longer periods, with the average age of operating US coal plants currently at 45 years.[10] Given that initial fixed costs represent a large share of total or levelized costs for these fossil fuel sources, locking them in risks locking in higher costs for TVA and its ratepayers.

In Alternatives A and B, the EPA recommends TVA consider the long-term financial liabilities associated with fuel price uncertainty, projections of falling technology costs, and how mitigation may reduce risk. Investing in long-lived combustion turbines due to inaccurate expectations about the costs of alternatives like solar may lead to higher overall costs. Moreover, long-lived fossil assets may become uneconomic faster than expected if alternatives and mitigation are not fully considered.

The EPA offers the following specific recommendations to consider and mitigate regulatory and energy transition risks:

a. *TVA should consider site characteristics that could promote or impede TVA responses to regulatory and technology developments.*

The EPA recommends that TVA consider the infrastructure and siting needs related to the need for future potential carbon mitigation measures at combustion turbines. TVA should also provide the total costs for these mitigation measures so that risks of financial impact are fully understood. TVA should assess: 1) space to locate carbon capture equipment or electrolyzers for clean hydrogen production; 2) pipeline routes and storage sites for potential CO_2 sequestration; and 3) any pipeline and/or storage needs associated with clean hydrogen.

b. *TVA should disclose why carbon mitigation options were not included or analyze those options in the FEIS.*

As TVA is aware, renewables and storage are not only projected to continue declining in cost over time while substantially reducing GHG and non-GHG pollution, but also to help stabilize domestic energy supply, e.g., renewable energy is less subject to global price fluctuations than natural gas.[11]

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[7] Ramasamy Vignesh, David Feldman, Jal Desai, and Robert Margolis. 2021. U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks: Q1 2021. Golden, CO: National Renewable Energy Laboratory. NREL/TP-7A40-80694. U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks: Q1 2021 (nrel.gov)

[8] https://rmi.org/report-release-headwinds-for-us-gas-power/

[9] U.S. utility-scale electric generating capacity by initial operating year (as of Dec 2016), U.S. Energy Information Administration - EIA - Independent Statistics and Analysis

[10] U.S. coal power plant capacity by initial operating year (1950-2021), U.S. Energy Information Administration - EIA - Independent Statistics and Analysis

[11] EPA. 2018. Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy: A Guide for State and Local Governments, EPA-430-R-18-00000

The FEIS should include a more detailed explanation of why options that included carbon mitigation were not more fully considered. Although TVA suggests it is considering transitioning the turbines built in Alternatives A or B to lower GHG emitting technologies, *e.g.*, hydrogen or carbon capture and storage (CCS), TVA neither commits to them, nor analyzes the potential resulting emissions reductions. For instance, in its site selection criteria, the DEIS does not consider access to clean hydrogen and or sequestration sites, nor sufficient room to add post combustion CCS or clean hydrogen. Further, the DEIS seems to have rejected considering those options in the short term. Given the trends noted above, the EIS should explain its choice not to consider them.

To help update the FEIS, TVA should review EPA's draft whitepaper on GHG measures for turbines.[12] For illustration, the EPA has included Table 1 containing a list of hydrogen and CCS projects currently under development with online dates in the 2025/2026 timeframe. The EPA recommends that TVA discuss its evaluation of these types of technologies as mitigation options, and whether TVA has any short or long-term plans to ensure there is a plan for reducing GHG emissions from new fossil assets like the turbines in alternatives A and B.

Table 1: Turbine projects with GHG mitigation technologies in development in 2026 timeframe

Type of	Location	Developer	Amount of	Current	Next	Projected -
Projects Where Construction Contract Has Been Awarded						
Hydrogen co-firing	Utah	Intermoun-tain Power[13]	30% Green Hydrogen Co-firing on day 1	Contracts Awarded for turbine/gen-erator – manufacture and construct	December 2022-Award hydrogen contract	July 2025
Projects On-line With Stated Commitment to Run on Green Hydrogen						
Hydrogen Co-firing	Ohio	Long Ridge Power Project[14]	Currently capable of burning 20% hydrogen	5% hydrogen Test Burn Completed – April 2022	Procure Green Energy	Currently on-line
Projects Where Decision To Build Is Expected Soon						
Oxy Combustion Turbine	Southern Ute Reservation, Colorado	Coyote Clean	100% Carbon Capture	February 2022 – Interconnection	Final Investment Decision	2025

[12] https://www.epa.gov/stationary-sources-air-pollution/white-paper-available-and-emerging-technologies-reducing
[13] https://www.ipautah.com/ipp-renewed/#
[14] https://www.longridgeenergy.com/news/2020-10-13-long-ridge-energy-terminal-partners-with-new-fortress-energy-and-ge-to-transition-power-plant-to-zero-carbon-hydrogen

Type of Project	Location	Developer	Amount of Carbon Mitigation	Current Status	Next Expected Milestone	Projected On-line Date
		Power[15], NET Power		application filed	Expected 2022	
Oxy Combustion Turbine	Illinois	ADM[16] – NET Power	100% Carbon Capture	April 2021 Agreement in principle	Final Investment Decision Expected 2022	2025
Oxy Combustion Turbine	UK	Sembcorp Energy – NET Power – Whitetail Energy[17]	100% Capture	July 2021 – project announced 2022 – Pre-FEED Study Completed	Regulatory Approval?	2025
Projects Considering Retro-fit CCS						
Retrofit CCS	Texas	Deer Park Energy Center[18]	95% capture	FEED study underway	TBD	TBD
Retrofit CCS	CA	Delta Energy Center[19]	95% capture	FEED study underway	TBD	TBD
Additional Hydrogen Turbine Projects Under Development						
Hydrogen Turbine	TX	Orange County Advanced Power Station[20]	30% hydrogen co-firing on day 1	Seeking PUC approval	Decision expected September 2022	May 2026
Electrolyzers Being Installed to Supply Green Hydrogen for Existing Turbine Project						
Electrolyzer	FL	Cavendish Next Gen Hydrogen Hub[21]	25 MW	Contract for Electrolyzer Awarded, Feb. 2022		

[15] https://www.prnewswire.com/news-releases/coyote-clean-power-begins-wapa-interconnection-301479049.html
[16] https://www.powermag.com/8-rivers-unveils-560-mw-of-allam-cycle-gas-fired-projects-for-colorado-illinois/ , https://www.prnewswire.com/news-releases/8-rivers-capital-adm-announce-intention-to-make-illinois-home-to-game-changing-zero-emissions-project-301269296.html
[17] https://energydigital.com/renewable-energy/whitetail-appoints-atkins-uks-first-net-zero-plant
[18] https://www.regulations.gov/comment/EPA-HQ-OAR-2022-0289-0016
[19] https://www.regulations.gov/comment/EPA-HQ-OAR-2022-0289-0016
[20] https://www.naturalgasintel.com/texas-combined-cycle-natural-gas-hydrogen-project-proposed-by-entergy/
[21] https://www.businesswire.com/news/home/20220228005567/en/FPL-Announces-Cummins-to-Supply-Electrolyzer-for-Florida%E2%80%99s-First-%E2%80%9CGreen%E2%80%9D-Hydrogen-Plant-%E2%80%93-Potential-Key-to-Carbon-Free-Electricity

c. TVA should consider and disclose potential fossil-fuel lock-in costs.

The EIS should analyze the potential for Alternatives A and B to lock-in fossil fuel use and production, along with the associated financial risks, when compared with energy resources with lower GHG emissions. The EIS should consider and disclose whether these alternatives—especially the preferred Alternative A's natural gas combined cycle unit and pipeline—could yield stranded assets due to market and policy factors that reduce demand for fossil-generated electricity.

III. The EPA recommends that TVA make specific updates to address all practicable mitigation measures.

The EPA recommends that TVA update Section 2.3, Identification of Mitigation Measures, to reflect all practicable mitigation measures. In Section 2.3 of the DEIS, the description of Air Quality and GHG mitigation does not adequately identify all practical mitigation measures for the proposed alternatives, does not address mitigation of GHG emissions, and does not include mitigation measures identified elsewhere in the DEIS. Further, the EPA recommends that the FEIS include any standard mitigations or Best Management Practices (BMPs) as a link or reference, if not included in the Appendix.

The EPA also recommends TVA adopt the proposal for the preferred alternative to use an electrified natural gas compressor. TVA should also adopt the recommendations of the EPA's Methane Challenge program to reduce potential GHG emissions attributable to the project. In addition, TVA should incorporate such mitigation measures into the proposed terms and conditions required as part of the pipeline contract.[22]

The EPA recommends that TVA consider the use of switchgears that are sulfur hexafluoride (SF_6) free for the proposed alternatives and system-wide as larger switchgears become available.[23] The DEIS indicates that small leaks of SF_6 are expected from gas-insulated switchgears. SF_6 is the most potent known GHG. Approximately 26,000 times more effective at trapping infrared radiation than carbon dioxide, SF_6 is also a very stable chemical, with an atmospheric lifetime of 3,200 years. Thus, a relatively small amount of SF_6 from each of the thousands of switchgears associated with the energy sector can have a significant impact. Emissions of SF_6 also come from the manufacture and recycling of SF_6, as well as charging, repairing, and decommissioning the switchgears. The EPA recommends that TVA consider the use of switchgears that are SF_6-free for the proposed alternatives, as well as system-wide, as larger switchgears become available.[24]

IV. TVA should include more meaningful consideration of emissions-reducing options in its alternatives analysis and craft an alternative that combines and blends energy resource measures.

The EPA recommends that TVA consider a blended alternative for formal analysis that combines the favorable aspects of the clean energy alternatives analyzed with other strategies TVA considered but did not further analyze. Such an approach would leverage energy efficiency and demand response measures to reduce summer and winter peak demand and implement a portfolio of alternatives—microgrids (*e.g.*, fuel cells in Nashville), rooftop and utility scale solar, and energy storage. A strategy that blends these

[22] https://www.epa.gov/natural-gas-star-program/recommended-technologies-reduce-methane-emissions
[23] https://www.epa.gov/eps-partnership
[25] https://www.epa.gov/eps-partnership

measures could be more cost-effective and mitigate the risks from GHG emissions, fuel price volatility, and technology uncertainty that accompany fossil fuels.

TVA may be able to lower or remove the need for 1,450 MW of capacity identified in Alternative A and meet its purpose and need on a more expedited timeline than Alternative C. To address one of TVA's core concerns, TVA may be able to reduce transmission upgrade costs associated with alternatives by targeting areas of transmission congestion with energy efficiency, demand response, distributed renewables, and energy storage measures.

Following these recommendations would both improve the EIS and be responsive to concerns from the House of Representatives Committee on Energy and Commerce that TVA has underinvested in energy efficiency and renewable energy to ratepayers' detriment.[25]

The EPA recommends that TVA consider the myriad benefits of incorporating energy efficiency and demand response into its proposed alternatives.

Energy efficiency and demand response would provide low-cost electricity and peak demand resources that could provide a significant portion of TVA's resource needs. Energy efficiency investment co-benefits include emissions reductions and local jobs and economic development.

Based on the performance of energy efficiency measures for other utilities in the Southeast region and nationally, TVA could improve overall system performance with energy efficiency measures. In 2019 and 2020, TVA's energy savings as a percentage of retail sales were 0.02% and 0.06%, respectively, while in 2020 the U.S. average was 0.72% and the southeastern utility average was 0.20%. TVA's regional peers, Duke Energy Carolinas and Duke Energy Progress achieved 0.8% or more each year from 2016 to 2020, more than 13x TVA's 2020 results.[26]

Further, consideration of the current cost, performance, and impacts of increased energy efficiency and demand response as a component of an additional alternative will help inform decision-makers and the public of the full range of reasonable alternatives to meet the project need. The TVA 2019 IRP did not provide information about the cost, performance, and impacts of increased energy efficiency and demand response program investment scenarios.

To underscore the value of this recommendation, TVA could yield meaningful annual savings with an alternative that includes energy efficiency measures. The EPA recommends that TVA evaluate as a component of a hybrid strategy a scenario where its current annual savings levels (0.06%) increase to 1% over a 5-year period, 2023-2027 (< 0.2% increase per year), and to 1.5% by 2030. Recent experience from other large utilities indicates that these levels are likely to be achievable and cost effective to TVA's customers. For example, 25 of the 52 largest electric utilities saved 1% or more according to a comprehensive assessment of utility efficiency performance.[27] In its most recent assessment, the Electric

[25] See, January 13, 2022 Letter from House Committee on Energy and Commerce to TVA https://energycommerce.house.gov/sites/democrats.energycommerce.house.gov/files/documents/TVA%20Letter%20re%20business%20practices%20and%20adherence%20to%20TVA%20Act.pdf.
[26] SACE. 2022. https://cleanenergy.org/wp-content/uploads/Energy-Efficiency-in-the-Southeast-Fourth-Annual-Report.pdf
[27] ACEEE. 2020. https://www.aceee.org/research-report/u2004

Power Research Institute has estimated state-level, economic energy efficiency potential of 16% of electricity demand in Tennessee by 2035.[28]

The EPA's Energy Savings and Impacts Scenarios Tool (ESIST) can be used to support this analysis by leveraging national data sets of energy efficiency program performance and impacts, and applying transparent and documented inputs.

V. The EPA recommends TVA disclose additional analysis regarding existing alternatives to better inform stakeholders.

The EPA recommends that TVA consider whether a reasonable range of alternatives would include additional renewable or non-gas alternatives beyond Alternative C, or that the EIS disclose additional analysis of why these alternatives were removed from consideration. For example, it would be helpful for TVA to provide additional information and analysis supporting the decision to dismiss wind energy from further consideration. As noted above, benefits of non-gas alternatives include not only GHG and non-GHG pollution emissions reduction, but also contributions to domestic energy stability, *e.g.*, renewables are less subject to global price fluctuations than oil and gas.[29]

The EPA recommends that TVA provide additional information on how timing considerations, including the requirement that resources be constructed and installed within a five-year timeframe, limited the alternatives options considered in the DEIS, including consideration of pumped water storage.

The EPA recommends the EIS include additional justification for why, in the context of the IRP, TVA has chosen the Cumberland site for the addition of combined cycle units. Given that the Cumberland site requires the construction of a 32-mile natural gas pipeline, it is unclear why an alternate site, such as Johnsonville, which has or will have natural gas capability would not meet TVA's purpose and need while significantly reducing environmental impact and expenditures associated with construction of a new pipeline. In relation, and as suggested above, TVA should disclose whether a diversified alternative of renewable energy resources that reduces capacity needs and transmission congestion could also reduce the need for a new pipeline.

The EIS should provide a more detailed cost breakout for each alternative and details on key assumptions that informed such costs. It should identify the fuel cost changes from each alternative and the total capital costs of building new generation and associated infrastructure like transmission upgrades. Such disclosures would highlight for TVA's ratepayers, other stakeholders, the public, and decisionmakers both the real cost drivers of the alternatives and the reasonableness of various assumptions that TVA makes in its analysis. The EPA appreciates TVA's duties with respect to least-cost planning under 16 USC 831m-1; pursuant to those provisions it would appear TVA is obligated to consider the full costs of its preferred alternative and renewable options, which may be the least cost supply. The EPA therefore recommends TVA be fully transparent with respect to any modeling of alternatives it conducts. For example, if TVA conducted modeling to evaluate reliability, costs, environmental performance, etc., it should make public its modeling assumptions (e.g., price of natural

[28] EPRI. 2017. https://www.energy.gov/sites/default/files/2017/05/f34/epri_state_level_electric_energy_efficiency_potential_estimates_0.pdf

[29] EPA. 2018. Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy: A Guide for State and Local Governments, EPA-430-R-18-00

gas, cost of battery storage) and the results of all model runs. The modeling should incorporate dynamic market trends and risks (e.g., climate transition risks), as well as examine appropriate policy-driven scenarios.

Since TVA signed a precedent agreement to purchase gas supply from Tennessee Gas Pipeline prior to issuing its DEIS preference for Alternative A, the EPA recommends TVA discuss how it maintains objectivity in the comparison of alternatives.

The EPA recommends discussing why the closely related, interdependent natural gas pipeline whose need is triggered by Alternative A is undergoing a separate and distinct NEPA review, rather than a joint NEPA document with Federal Energy Regulatory Commission (FERC) as provided by 40 CFR § 1501.9(e).

VI. The EPA recommends TVA disclose all direct and indirect GHG emissions for each alternative.

The EPA recommends disclosure and consideration of all direct and indirect project GHG emissions, including upstream and pipeline emissions. TVA should analyze GHG emissions in the context of national and state GHG reduction targets and policies. TVA's revised analysis should inform and improve TVA's consideration of mitigation measures and climate adaptation. Also, as recommended in detail below, this discussion should inform TVA's improved disclosure of climate impacts using the estimated social cost of GHGs (SC-GHG).

a. The EPA recommends TVA quantify and further consider all direct and indirect GHG emissions from each alternative.

The EPA recommends quantification of all reasonably foreseeable direct and indirect GHG emissions (*e.g.,* carbon dioxide (CO_2), methane, and nitrous oxide (NO_x)) attributable to the proposed action and alternatives. Quantification should include upstream emissions (exploration, extraction, processing, and pipeline transmission), plant and pipeline construction emissions, and combustion-related methane emissions. Upstream methane emissions from coalbeds and natural gas systems are likely to be substantial despite the increased regulation, improved practices, and new technologies mentioned in the DEIS. Research also suggests that these methane emissions are larger than previously expected.[30] Even though methane emissions may be smaller than CO_2 emissions, they still represent potentially substantial impacts on social welfare and the environment. EPA uses a Global Warming Potential (GWP) of 27-30 for methane over 100 years, indicating that one ton of methane has the same warming potential as 27-30 tons of CO_2. As TVA accounts for emissions of additional gases (including methane), the EPA recommends that the relevant SC-GHG be applied to the respective emissions of each gas. For example, the SC-CH_4 should be applied to methane emissions. It would be inappropriate to convert emissions to CO_2 equivalents and apply the SC-CO_2.

The EPA recommends the EIS provide further narrative explanation of the emissions trends in the GHG analysis presented in DEIS Tables 3.7-3 and 3.7-4 (pp. 191-192). Specifically, the EIS should explain why the No Action Alternative emissions generally decrease until 2034 and then increase thereafter. Additionally, the EPA recommends that the EIS explain why Alternative C (solar and storage) emissions

[30] Alvarez, R. A., et al. (2018). "Assessment of methane emissions from the U.S. oil and gas supply chain." Science 361(6398): 186-188

are higher than No Action Alternative emissions through 2024. The EPA also recommends an explanation of the similarity between Alternatives A, B, and C emissions in 2041.

In this context, given that there are substantial differences in the monetized costs of CO_2 emissions across the alternatives, the EPA recommends TVA address and justify its conclusion that, *"The SCC results for TVA system-wide effects essentially show that all the alternatives are very close regarding their overall GHG effects…" (p. 186).*

The EPA recommends the EIS explain why the GHG analysis considers a 20-year horizon to 2041 and whether this time horizon is sufficient to analyze trade-offs among emissions trajectories. Gas-powered combined cycle units had an average retirement age of 30 years in 2018, suggesting that a 20-year horizon is too short.[31] To address this issue and related analytical shortcomings, the EPA recommends comparing the proposed projects' long-term generation impacts with energy use trajectories consistent with achieving science-based targets for GHG reduction. For example, a new natural gas-fired generating station could replace electricity generation from an existing coal-fired generating station in the near term, but lock in fossil fuel consumption for decades, forcing future trade-offs between now-existing natural gas generation and future renewable energy generation. As discussed above, the EPA recommends the EIS discuss how TVA will manage existing natural gas generation to achieve critical GHG-reduction goals. For important context, the EPA also recommends further explanation of TVA's plans for replacing the remaining lost capacity from retiring the Cumberland coal plant.

The EPA recommends that TVA avoid expressing project-level GHG emissions as a percentage of national or state GHG emissions. The DEIS approach of comparing project-level emissions to national and state emissions diminishes the significance of substantial project-scale GHG emissions. This approach is also misleading given the nature of the climate policy challenge to reduce GHG emissions from a multitude of sources, each making relatively small individual contributions to overall GHG emissions. Instead, the EPA recommends that the FEIS include a discussion of whether and to what extent the estimated GHG emissions from the proposed alternatives are consistent with taking action to achieve science based national GHG reduction targets and any relevant state or local goals, as noted above. Since the proposed action tiers off the 2019 IRP, this analysis should include a discussion of how the proposed action and 2019 IRP will achieve GHG reduction targets.

b. The EPA recommends TVA provide details and assumptions underlying its system model.

The DEIS indicated that a system-wide model was used to generate the assumptions for displacement of higher emitting alternative fuels and the calculations of GHG emissions associated with each alternative, but the DEIS does not provide specific details on this model. The EPA recommends that the details of the displacement modeling be fully specified and explained in the FEIS so that the underlying uncertainty and assumptions are clear. For instance, the GHGs in the No Action Alternative that are being displaced should be quantified and monetized using the SC-GHG. It is not clear how this modeling comports with broader TVA system plans that include additional renewables in later years, or whether the costs of keeping coal operating are reflected in the analysis. Where possible, peer reviewed methods should be used for modeling.

[31] "Average age of US power plant fleet flat for 4th-straight year in 2018", S&P Global https://www.spglobal.com/marketintelligence/en/news-insights/trending/gfjqeFt8GTPYNK4WX57z9g2

The EPA recommends that TVA reach out to the National Renewable Energy Lab, (NREL) for a consultation on grid integration. NREL can perform studies to address reliability under high-renewable energy scenarios.

c. *The EPA recommends that TVA should align its baseline model in the No Action Alternative with the planned retirement dates of the CUF EGUs. In the alternative, TVA should provide a detailed explanation and justification for keeping a baseline model that assumes continued operation of EGUs planned for retirement.*

Both Cumberland coal-fired units have already filed a Notice of Planned Participation to comply with the EPA's 2020 Steam Electric Effluent Guideline rule (ELG rule), which indicates that that TVA will permanently cease coal combustion by 2028 at both units.[32] In addition, Unit 2 has an indicated retirement date of 2026 in the EPA's NEEDS database, which is compiled using public filings, such as Energy Information Administration's Form-860. However, the DEIS considers the benchmark counterfactual to be a No Action Alternative where both units operate past 2040. TVA should explain these varying representations. Presumably there are additional costs associated with keeping the coal operating and it is not clear whether this is accounted for in the DEIS, along with other potential conflicts. Such costs should be disclosed in detail. To ensure consistency, the EPA recommends that TVA align the modeling for GHG calculations with the other plans in the document.

The EPA recommends that the FEIS consider how each alternative compares with scenarios consistent with achieving science based GHG reduction goals, rather than solely against a "business as usual" baseline of high fossil fuel use. The DEIS compares the alternatives with a No Action baseline of continued operation of two coal-fired generation units, rather than evaluating how these alternatives compare with actions the United States must take in order to meet GHG reduction goals. If TVA continues to use the No Action Alternative, TVA should address the likelihood that the plant would still need to be replaced within the planning horizon and/or would be required to address its substantial GHG emissions. The EPA recommends accounting for the potentially substantial costs associated with both complying with the ELG rule and with other operation and maintenance needed to keep the plant running.

VII. TVA should update its SC-GHG analysis to accurately reflect the alternatives' monetized cost, incorporating climate impacts from both direct and indirect GHG emissions.

The EPA strongly recommends that TVA apply estimates of the SC-GHG to monetize the societal value of the direct and indirect GHG emissions resulting from the proposed project. The fact that the SC-GHG estimates do not provide a basis to designate a particular monetized value as significant does not diminish their usefulness. Valuing these emissions separately discloses the different environmental impacts associated with emissions of each of the GHGs.[33]

The EPA recommends the February 2021 interim SC-GHG estimates developed by the Interagency Working Group (IWG) on the SC-GHGs as the most appropriate current estimates for use in policy analysis until an improved estimate of the impacts of climate change can be developed based on the best available science and economics taking into consideration recommendations from the National

[32] Steam Electric Reconsideration Rule, 85 Fed. Reg. 64670-01 (Oct. 13, 2020)
[33] EPA also has additional information at https://www.epa.gov/global-mitigation-non-co2-greenhouse-gases

Academies of Sciences, Engineering, and Medicine (National Academies 2017).[34] When applying SC-GHG estimates, TVA should disclose the associated assumptions (*e.g.*, discount rates) and uncertainties, which are lacking in the current application in the DEIS. Furthermore, the EPA recommends against characterizing any SC-GHG estimates as an "upper bound" of climate change impacts in the FEIS. The IWG's 2021 Technical Support Document presents a range of estimates and discount rates and discusses the uncertainties and the many categories of damages that are not yet reflected in existing SC-GHG estimates. Data and modeling limitations therefore naturally limit the SC-GHG estimates to be a partial accounting of climate change impacts, making it incorrect to assert an upper bound using only one of the SC-GHG estimates.

To clarify a legal point TVA raises in the DEIS, the EPA does not agree that there is "legal uncertainty" regarding SC-GHG values. EO 13990 directed the IWG to publish the interim SC-GHG estimates for agencies to use "when monetizing the value of changes in GHG emissions resulting from regulations and other relevant agency actions until final values are published."[35] Estimates of the social cost of carbon (SC-CO_2) have been published in peer reviewed academic literature for decades, and the SC-GHG metric has been regularly incorporated into federal policy analysis since the late 2000s, following a 2008 Ninth Circuit Court of Appeals remand of a rule for failing to monetize the benefits of reducing CO_2 emissions.[36] While the interim estimates proposed by the IWG have been the subject of litigation, there are currently no legal constraints on the use of these estimates, which were developed under a robust and transparent process, represent the best available science and economics, and provide essential impact information to the public and decisionmakers.

The EPA also recommends against applying the SC-GHG estimates developed under EO 13783 (revoked),[37] because the full impact of GHG emissions is not reflected in multiple ways. First, those estimates fail to capture many climate impacts that can affect the welfare of U.S. citizens and residents. Examples of affected interests include direct effects on U.S. citizens and assets located abroad, international trade, tourism, and spillover pathways such as economic and political destabilization and global migration that can lead to adverse impacts on U.S. national security, public health, and humanitarian concerns. Assessing the benefits of U.S. GHG mitigation should also incorporate how those actions may affect mitigation activities by other countries, as those international actions will benefit U.S. citizens and residents. Scientific and economic experts have emphasized reciprocity as support for considering global damages of GHG emissions. Using a global estimate of damages in U.S. analyses allows the U.S. to continue to actively encourage other nations, including emerging major economies, to take significant steps to reduce emissions.

The SC-GHG estimates based on a 7% discount rate (to approximate the social rate of return on capital) inappropriately underestimate the impacts of climate change when discounting the future benefits of reducing GHG emissions. Consistent with the findings of the National Academies, the economic literature and the IWG, the EPA agrees with the assessment that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context, and that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates. Furthermore, the impacts of climate change are measured in consumption-equivalent

[34] February 2021 Technical Support Document (TSD), Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990

[35] Executive Order 13990: Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis (January 20, 2021).

[36] *CBD v. NHTSA*, 538 F.3d 1172 (9th Cir. 2008)

[37] Revoked on January 20, 2021, via E.O. 13990.

terms in the models used to estimate SC-GHG, so it is appropriate to use the consumption discount rate to calculate the SC-GHG.

The EPA recommends several additional corrections and clarifications related to the SC-GHG discussion and the analysis presented in Tables 3.7-3 and 3.7-4 of the DEIS (pp. 191-192):

- Following best practice with benefit cost analysis, the EPA recommends discounting nominal values using nominal discount rates. The EPA recommends that the nominal discount rate should be the real discount rate plus the inflation rate. Alternatively, the values in these tables could be presented as real values (using the same base year dollars, unadjusted for inflation) rather than nominal values. Undiscounted sums (Table 3.7-3) should also be avoided.
- The EPA recommends using internally consistent discount rates for SC-GHG and Net Present Value (NPV) calculations. In particular, DEIS Table 3.7-3 (p. 191) uses a 7% discount rate for NPV calculations, while the SC-GHGs were calculated using a 3% discount rate.
- The EPA recommends that the TVA clarify the characterization that the SC-GHG "does not measure the actual incremental effects of an individual project." TVA states: *"The SCC metric does not measure the actual incremental effects of an individual project due to both scale and complexity." (p. 186).* GHGs are globally mixed, so the SC-GHG is well suited to measure the effect of individual projects. The SC-GHG is an estimate of the marginal social cost of emissions, which is the correct estimate to be applied to the scenarios considered in this DEIS.
- The EPA recommends revising the definition of the SC-GHG to clarify that the SC-GHG collectively refers to the SC-CO_2 and other GHGs (including, for example, the social cost of methane (SC-CH_4) and social cost of nitrous oxide (SC-N_2O)). The EPA also recommends the FEIS use "SC-GHG" and "SC-CO_2" as appropriate rather than "SCC." The definition should also clarify that in practice what is reflected in SC-GHG estimates is limited by data and available modeling methods. We recommend the following revision: "The SC-GHG is the monetary value of the net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year. In principle, it includes the value of all climate change impacts (both negative and positive), including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk and natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. In practice, estimates of the SC-GHG are unable to include all of the important physical, ecological, and economic impacts of climate change due to data and modeling limitations."
- The EPA recommends a consistent use of both the terms "social cost" and "social benefits." For projects that decrease emissions, the decrease multiplied by the SC-GHG can be either labeled as a negative cost or a positive benefit. The term "social cost benefit" is confusing and unclear. It may be confused with the term "social cost-benefit" or "social cost and benefit," which both refer to a complete assessment of the costs and benefits. For example, DEIS Table 3.7-6 is labeled *"Social Cost Benefit of GHG Operational Emissions Reductions."* However, this table is only presenting the social benefits (or negative costs). Furthermore, this table labels columns as the "Net SCC Benefit" and list benefits (or negative costs) as a negative value. The term "Social Cost of Carbon (SCC) Benefits" is unclear as to its meaning.
- The EPA recommends the SC-GHG be applied to the incremental emissions from the proposed Alternatives, as opposed to TVA-wide emissions. For example, to describe the emission benefits of Alternative C, the SC-GHG may be applied to the difference in emissions between Alternatives A and C. Alternatively, TVA could choose some plausible reference case for the system-wide modeling (*e.g.,* a preferred scenario TVA uses in its IRPs and other long-term

planning). TVA could then apply the SC-GHG to the incremental emissions from each Alternative relative to the reference case emissions. Applying the SC-GHG to total TVA-wide emissions under each Alternative obscures the relative impacts of the Alternatives. On a percentage basis, the differences in TVA-wide emissions may be relatively small across Alternatives, which can suggest the problematic conclusion that emissions across Alternatives are "similar." Although the DEIS only includes a time path for carbon emissions, we were able to apply the SC-GHGs to the carbon emissions in Table 3.7-3. Our estimates show that the difference between the monetized value of carbon between alternative A and alternative C is $1.1 billion dollars (in net present value out to 2041), when using the SC-GHG value in 2021 real dollars). That does not include the monetized impacts of methane or N_2O, which will drive that value larger. Furthermore, while the DEIS does not specify the size of the pipeline for Alternative A or its volume per day, Page 19 of the document states "Preliminary estimates indicate that approximately 250,000,000 standard cubic feet per day of natural gas would be required for the CC plant." Based on estimates from EPA's Inventory of US GHG Emissions and Sinks, that natural gas will yield total upstream emissions of approximately 487,601 metric tons of CO_2, 11,518 metric tons of CH_4, and 1.1 tons of N_2O. Using a 3% rate for the SC-GHG, that yields an additional $817 million dollars in net present value (2021 dollars).

VIII. The EPA recommends that TVA consider and disclose climate resilience and adaptation planning in project design.

The EPA recommends that the EIS consider and disclose climate resilience and adaption planning in project design, including measures to ensure resilience to protect infrastructure investments from the effects of climate change on the project. By considering potential climate change impacts, TVA would help ensure that investments made today continue to function and provide benefits, even as the climate changes. This would also help TVA avoid making infrastructure investments in vulnerable locations, along with unintended impacts to local communities.

- Section 3.7.2.3.1 of the DEIS discusses the potential climate impacts from increases in ambient temperature on combustion turbine operational efficiency and potential impacts of flooding on the project. The DEIS also indicates that TVA has developed a Climate Action Adaptation and Resiliency Plan to identify risks associated with and plan for climate change effects. We recommend that the FEIS specifically reference or provide a link to this plan, as well as refer, in the climate section, to the flood mitigation measures that are included elsewhere the document.
- The EPA also recommends that the FEIS address whether and to what extent each of the alternatives is resilient or vulnerable to outages, with the expectation that climate change will increase impacts that could affect risks to reliability. If TVA plans to cite reliability as a concern related to Alternative C, the EPA recommends that TVA detail the modeling scenarios that produce electricity supply shortfalls.

IX. TVA should more broadly consider the Environmental Justice impacts of its alternatives.

TVA evaluated demographic data of the population near the CUF reservation, along the proposed pipeline corridor, and contiguous counties. Four census block groups were found to have significant populations of residents living in poverty. Generally, the DEIS discussions of environmental justice impacts appear to assume that various environmental impacts are not anticipated to be disproportionate on the identified environmental justice populations because similar effects would occur to other

populations in the area. Although similar impacts may occur in the general population, these effects may be amplified in some communities with environmental justice concerns due to health, socioeconomic, or cultural vulnerabilities. CEQ's environmental justice guidance states that Agencies should recognize the interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed agency action. For example, if the residents living in poverty rely more heavily on fishing or hunting for subsistence, they will be more adversely affected by impacts to aquatic and wildlife resources. Similarly, temporary or permanent effects to prime farmland relied on by low-income farmers could potentially be more severe than to the general population.

- The EPA recommends that the EIS identify and disclose reasonably available information from affected communities and other appropriate sources about susceptibilities or vulnerabilities that could potentially amplify the environmental justice impacts discussed in the DEIS. This information should be taken into account in concluding that the proposed project's environmental impacts on environmental justice populations are the same as those on other populations in the area.
- TVA should also account for impacts resulting from the construction and operation of the natural gas pipeline that is required to operate the preferred alternative. The EPA notes that the pipeline contractor has begun coordination with landowners for the purchase of easements and coordination with local governments and federal agencies for required permits. Though there is a separate process for permitting pipelines administered through FERC and a separate NEPA analysis is planned to specifically analyze the pipeline, any reasonably foreseeable disproportionate impacts to communities with environmental justice concerns should be identified and addressed, consistent with EO 12898. This would include not only potential air quality and other impacts on these communities, but also ensuring equitable use of eminent domain and consideration of possible pipeline failures. This analysis should also include consideration of the cumulative pollution and non-pollution burdens on the communities with environmental justice concerns, which can make those communities more susceptible or vulnerable to environmental impacts.
- The EPA also recommends that the discussion of climate change and GHGs acknowledge the disproportionate impact that GHG emissions have on already overburdened and vulnerable communities. See, *e.g.*, *Climate Change and Social Vulnerability in the United States*, EPA (2021). Similarly, the alternatives discussion should recognize the differences in the GHG emission impacts of each alternative on those vulnerable communities. Also, the environmental justice analysis of non-GHG stressors should include ongoing and projected climate-related impacts, consistent with section 219 of EO 14008.

X. EPA recommends TVA mitigate for unavoidable losses to streams and wetlands.

CUF contains several wetlands and tributaries to the Cumberland River. The proposed pipeline corridor parallels an existing transmission line corridor that crosses interspersed creeks and wetlands. TVA will potentially impact 7,239-Linear Feet (LF) of streams and 29.4-acres of wetlands at the power plant site, and 11,620-LF of streams along the pipeline corridor. Additional impacts from in-water work along the Cumberland River may result from planned upgrades to existing piers. The EPA understands that TVA is coordinating with the U.S. Army Corps of Engineers (USACE) regarding impacts to Waters of the United States (WOTUS). TVA regulations additionally require a 50-foot buffer around streams, wetlands, and ponds.

- The EPA recommends continued coordination with USACE to acquire mitigation credits within the Cumberland and Tennessee River watersheds.

XI. TVA should monitor stormwater discharges and maintain best management practices.

The DEIS indicates TVA will acquire a National Pollutant Discharge Elimination System construction stormwater general permit and implement a stormwater pollution prevention plan to mitigate effects from the temporary disturbance of soils during construction. BMPs, as described in TVA's BMP manual and the Tennessee Department of Environment and Conservation Erosion and Sediment Control Handbook will be used to avoid contaminating surface waters near and downstream of construction sites.

- The EPA recommends continuous monitoring of surface water discharges in accordance with TVA's industrial stormwater and construction stormwater permits, and maintenance of BMPs, to ensure pollutants do not enter WOTUS. The Proposed Action Alternative will create impervious surfaces that should be managed with attenuation features to maintain existing stormwater runoff profiles.

XII. TVA should manage and contain hazardous materials.

CUF is currently a small-quantity generator of hazardous wastes and produces approximately 1.2-million tons of solid coal burning byproducts annually. Demolition of CUF, that is analyzed under all three proposed actions, will temporarily produce large quantities of several regulated wastes including asbestos, lead, mercury, polychlorinated biphenyls, and volatile organic compounds.

- For the protection of drinking water resources, WOTUS, and as required by the Clean Water Act, the EPA recommends the use of secondary containment where storage and handling of Petroleum, Oils, and Lubricants (POL) will take place. Where secondary containment is not directly practicable, spill ponds and oil water separators should be constructed downstream of POL related activities. Construction and operation in support of the project should ensure that Resource Conservation and Recovery Act-regulated solid wastes generated are disposed of in accordance with federal regulations.

XIII. TVA should continue coordination with the Service on impacts to biological resources.

The EPA understands the CUF reservation is primarily industrialized, while the proposed pipeline corridor consists mostly of forest and grassy fields. Section 3.8.2.1.2.2 states that plant and wildlife surveys of the proposed pipeline corridor are being conducted by the contractor as part of the separate permitting process administered by FERC.

- The EPA notes that the proposed natural gas pipeline is related to the proposed action alternative and associated impacts should be analyzed as a whole. The EPA principally defers to the U.S. Fish and Wildlife Service (FWS) regarding compliance with the Endangered Species Act and recommends early coordination. Results of FWS consultation should be included in the FEIS.

XIV. Floodplain analysis should inform site design.

Section 3.4.2 of the DEIS indicates that portions of the proposed power plant site and gas pipeline will be within the 100-year floodplain and TVA is developing plans to address siting infrastructure within the floodplain and requirements of relevant executive orders. The DEIS indicates that critical powerplant components will be constructed outside of the floodplain. Response measures for flooding during construction are identified in section 3.5.2.3.3.1.

- The EPA recommends evaluating long term site planning and water requirements of proposed energy sources alongside projected river flows and water availability throughout the sources proposed service life. The EPA understands that the proposed alternative will primarily use air cooling for turbines and be somewhat resilient to decreased flows of the Cumberland River. However, a reversal of trends in this river basin could elevate the existing floodplain and present future climate-based challenges to energy resiliency.

TENNESSEE VALLEY AUTHORITY

400 West Summit Hill Drive, Knoxville, Tennessee 37902

July 27, 2022

Mr. Mark Fite
Director
Strategic Programs Office
Environmental Protection Agency
Atlanta Federal Center
61 Forsyth Street
Atlanta, Georgia 30303-8960

Dear Mr. Fite:

CUMBERLAND FOSSIL PLANT (CUF) RETIREMENT AND REPLACEMENT GENERATION FINAL ENVIRONMENTAL IMPACT STATEMENT (EIS) – COOPERATING AGENCY REQUEST

This letter responds to the request of the Environmental Protection Agency (EPA) to participate as a cooperating agency in the above-referenced Final EIS currently being prepared by the Tennessee Valley Authority (TVA).

The EIS involves TVA's CUF Plant, which is a two-unit, coal-fired steam generating plant with a summer net generating capacity of 2,470 megawatts (MW) located in Cumberland City, Stewart County, Tennessee. The proposal to retire CUF implements the planning direction in TVA's Integrated Resource Plan (IRP) that was adopted by the TVA Board in 2019. This planning direction affirmed TVA's commitment to retire additional coal capacity beyond the announced plan to retire Bull Run in 2023. The types of generation resources necessary to replace the generation capacity retired at CUF is also guided by the planning direction in the 2019 IRP. For such replacement, the IRP contemplates the addition of up to 5700 MW of combined cycle (CC) capacity, up to 5300MW of combustion turbine (CT) capacity, and up to 8000MW of solar capacity, by 2028. The alternatives analysis in the DEIS for the CUF retirement and replacement project is driven by the planning direction adopted by the TVA Board in the 2019 IRP after accounting for constraints such as the need for 24x7 synchronous generating capacity when replacing the CUF generation as well as the necessity to keep the grid resilient and reliable.

In the assessment conducted under the subject EIS, TVA proposes to retire both CUF units and add at least 1,450 MW of firm, dispatchable replacement generation to recover the generation capacity lost from retirement of one CUF unit. Replacement generation of this capacity will allow TVA to recover the dependable capacity of the first unit as well as account for modest load increases driven by residential growth from higher Valley in-migration paired with slightly higher industrial load. The replacement generation would need to be online prior to retirement of the first CUF unit so that electric service to the public is not disrupted by the retirement of the coal-fired generation. To meet the need for timely replacement generation, TVA started the National

Environmental Policy Act (NEPA) process in January 2021, and planned the process so that a Final EIS would be available to the public by November 2022. Planning for the replacement generation for the second retired CUF unit would be deferred to allow additional time for the assessment of specific types and locations of that generation.

Although TVA's Draft EIS evaluates three alternatives for replacement generation along with the no action alternative, TVA's preferred alternative is the retirement of CUF and construction and operation of a CC Combustion Turbine Gas Plant on the CUF Reservation. This is TVA's preferred alternative in the Draft EIS because this asset not only provides dispatchable capacity, but it is also capacity that is synchronized to the grid and will therefore be able to meet TVA's load shape on a seasonal basis. In addition, this gas asset is necessary to support the reliable integration of intermittent resources on TVA's grid, with TVA planning to add as much as 10,000MW of intermittent renewable generation (e.g., solar generation) by 2035. The 2019 IRP recognizes that the need for future CC and CT capacity is driven by the demand for electricity and gas prices, but also by the degree of solar penetration.

On May 11, 2021, TVA published a Notice of Intent to prepare an EIS to address the retirement and demolition of CUF, and the addition of replacement generation to recover the generation lost from retirement of one CUF unit. On June 9, 2021, TVA received scoping comments from EPA providing input on the project alternatives, which TVA considered in preparation of its Draft EIS. On April 29, 2022, EPA published a Notice of Availability of TVA's Draft EIS for the retirement and demolition of the CUF and the replacement of part of the retired generation. Despite EPA's early involvement with and awareness of this environmental review, TVA did not receive a cooperating agency request from EPA until June 30, 2022, when EPA submitted its comments on the Draft EIS. TVA agreed to consider EPA's comments even though EPA submitted them after the comment period for the Draft EIS had closed.

Notwithstanding the late stage at which TVA has received EPA's request for cooperating agency status and conditioned upon EPA's agreement to adhere to TVA's existing schedule, TVA agrees to cooperate with EPA to address EPA's comments on the Draft EIS with respect to the following areas: (1) estimates of greenhouse gases (GHG) and other pollutant emissions; (2) practical mitigation measures to reduce GHG and other pollutant emissions for alternatives involving natural gas; and (3) climate analysis. In order to preserve the NEPA schedule under which the Final EIS would be available to the public in November 2022, TVA's coordination with EPA to address its comments will be completed by October 21, 2022. Further, we understand that EPA's cooperating agency status would not preclude its independent review and comment responsibilities under Section 309 of the Clean Air Act or preclude the Agency's responsibilities for any other environmental consultations required by law.

In closing, TVA's cooperation with EPA on the above issues would be mutually beneficial and would help facilitate TVA's "hard look" at the environmental consequences of the studied alternatives. Again, TVA appreciates the opportunity to work with the EPA as a cooperating agency on these matters. We look forward to discussing the comments you provided on the Draft EIS and will reach out to set up a Webex call for this purpose. If you have any questions,

please contact Ashley Pilakowski, TVA NEPA Specialist, by email, aapilakowski@tva.gov, or by phone 865) 632-2256.

Sincerely,

Dawn Booker
Manager
NEPA Program

Cumberland Retirement and Replacement Generation

Environmental Impact Statement

TVA – EPA Call
August 19, 2022

TENNESSEE VALLEY AUTHORITY

Focusing on three main comments from EPA

- Greenhouse Gas Emissions and other Pollutants
- Practical Mitigation Measures to Reduce GHG and Other Pollutants
- Climate Analysis

Greenhouse Gas (GHG) Emissions and other Pollutants

- Performing a lifecycle analysis of the Alternatives
- Quantifying all direct and indirect GHG emissions/pollutants
- Including upstream and downstream emissions of all Alternatives
- Will include comparison between Alternatives as well as a system level comparison

Practical Mitigation Measures to Reduce GHG and Other Pollutants

- Research practicality of various mitigation measures; hydrogen blending and CCS
- Incorporate the space and equipment needed for future CCS and hydrogen blending
- Plan to procure equipment with the capability to utilize blended hydrogen fuel

Pre-decisional & Deliberative

Climate Analysis

- Include measures identified in TVA's Climate Action Adaptation and Resiliency Plan
- Incorporate flood mitigation measures into climate section
- Address the resiliency of each Alternative due to climate impacts

Pre-decisional & Deliberative

Next Steps

1. EPA provide written feedback to TVA by September 2, 2022
2. TVA provide the following draft Sections to EPA by September 30, 2022 (or earlier):
   - Mitigation Measures
   - Air Quality
   - GHG
   - Climate
3. EPA provide comments to TVA by October 7, 2022
4. Schedule a follow-up call week of October 9, 2022

Pre-decisional & Deliberative

TVA Responses to EPA Comments on the Mitigation Measures, Air Emissions, Climate and Social Cost of Greenhouse Gases Sections of the Cumberland Fossil Plant Retirement Draft Final Environmental Impact Statement

TVA Responses to EPA Comments on the Draft FEIS for the Cumberland Fossil Plant Retirement Sections on Air Emissions and Social Cost of Greenhouse Gas (GHG)
October 7, 2022

1. Section 2.3.2 most directly addresses the EPA's previous comments on Carbon Capture and Sequestration (CCS) implementation at CUF. The EPA recommends that the FEIS further identify the nearest sites to safely store CO2 and take other preliminary measures that more fully indicate the feasibility and logistics of implementing CCS technology, however infeasible that may currently be. The EPA also recommends that TVA further expound on this sentence: "TVA has committed to ensuring that plant design associated with Alternative A would enable future modifications for carbon capture and the combustion of hydrogen as a replacement or supplemental fuel for natural gas as the technologies mature", to provide details of what this means. It could mean that TVA will purchase a turbine that is capable of burning 100% hydrogen, should they get the supply, or that they have room on the site for CCS post combustion capture equipment and a commitment to find a disposal site. The EPA recommends that TVA provide a more comprehensive explanation of the proposed plan to zero carbon and how Alternative A fits in that plan, the more defensible the EIS will be.

   TVA Response: Additional details regarding TVA's non-routine mitigation measures have been included in Section 2.3.2 of the Final EIS.

2. The EPA recommends replacing the introductory definition of climate change on p.1 of Section 3.7 to reflect the IPPC6 frame of anthropogenic climate change.

   TVA Response: The framing of climate change in the industrial era due to anthropogenic GHG emissions has been revised in the first page of Section 3.7 of the Final EIS.

3. The EPA reiterates the importance of using the February 2021 interim SC-GHG estimates developed by the Interagency Working Group (IWG) on the SC-GHGs as the most appropriate current estimates for use in policy analysis. The current draft uses two different SC-GHG's, including one from the previous presidential administration that has since been revoked and is inconsistent with recommendations from the National Academy of Sciences. In section 3.7.1.1.8, the document states that there is legal uncertainty "regarding the propriety of social cost of SC-GHG rate," and that "presenting social costs as a range of values from successive Administrations provides decision-makers and the public with better information in an area fraught with uncertainty." EPA disagrees with both statements, as there is useful guidance on the appropriate application of the SC-GHG in NEPA analysis in CEQ's 2016 NEPA climate guidance. The EPA does not agree that there is "legal uncertainty" regarding SC-GHG values. EO 13990 directed the IWG to publish the interim SC-GHG estimates for agencies to use "when monetizing the value of changes in GHG emissions resulting from regulations and other relevant agency actions until final values are published."[1] Estimates of the social cost of carbon (SC-CO2) have been published in peer reviewed academic literature for

[1] Executive Order 13990: Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis (January 20, 2021).

decades, and the SC-GHG metric has been regularly incorporated into federal policy analysis since the late 2000s, following a 2008 Ninth Circuit Court of Appeals remand of a rule for failing to monetize the benefits of reducing CO2 emissions.[2] While the interim estimates proposed by the IWG have been the subject of litigation, there are currently no legal constraints on the use of these estimates, which were developed under a robust and transparent process, represent the best available science and economics, and provide essential impact information to the public and decisionmakers.

TVA Response: Comment noted. Section 3.7.2 of the Final EIS includes SC-GHG estimates based on the current IWG guidance, which includes the broader global range of climate impacts, as well as estimates used under the Trump Administration for conducting cost-benefit analysis for rulemakings, thereby offering a range of potential impacts for the GHG analysis Presenting the social costs as a range of values from successive Administrations provides decisionmakers and the public with better information for making an informed decision. The primary analysis of the climate impacts is provided by the proxy emissions analysis in the EIS, with the SCC analysis added to supplement the climate analysis.

4. The TVA-wide estimates in Table 3.7-3 only value the impact of CO2 and ignore the other two GHGs (methane (CH4), and nitrous oxide (N2O)). This can significantly bias the resulting estimates. Currently, Alternative A appears to have the lowest monetized impact. However, that option has large methane emissions which are not accounted for.

   TVA Response: The LCA analysis has been included in the Final EIS to provide comparisons of CO_2, N_2O, and CH_4 emissions under each alternative. The LCA analysis has been conducted both at the individual resource level as well as the system-wide basis. The system-wide analysis is important since it considers net changes in generation supplied by the remaining TVA fleet on an ongoing basis as compared to the No Action alternative. Consistent with EPA's recommendation, the Final EIS has been revised to use SC-CO_2, SC-N_2O, and SC-CH_4 and the sums of the social costs of these three GHGs are presented as the SC-GHG in conducting the LCA.

5. The EPA recommends using internally consistent discount rates for SC-GHG and Net Present Value (NPV) calculations. For example, Table 3.7-3 uses the 3% SC-GHG value and then a 7% discount rate for NPV., which is inconsistent. Furthermore, the SC-GHG estimates based on a 7% discount rate (to approximate the social rate of return on capital) inappropriately underestimate the impacts of climate change when discounting the future benefits of reducing GHG emissions. Consistent with the findings of the National Academies, the economic literature and the IWG, the EPA agrees with the assessment that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context, and that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates.

[2] *CBD v. NHTSA*, 538 F.3d 1172 (9th Cir. 2008)

TVA Response: TVA utilizes a 7% discount rate when performing all financial analysis which requires discounting. It would be inconsistent for TVA to depart from its normal practice by applying a different discount rate than 7% just to compare the SC-GHG between alternatives on an NPV basis.

6. The SC-CO2, SC-CH4, and SC-N2O should not be adjusted by an inflation factor as is done in Appendix I in Tables I.6-12, I.6-14 and I.6-16, respectively, and again in Table 3.7-3 in Section 3.7 to obtain nominal values. The estimates of SC-GHGs found in the "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990" (SC-GHG TSD) published in February 2021 are the appropriate values to use when analyzing projects that affect GHGs. To monetize the value of changes in GHG emissions, the annual emissions of each greenhouse gas should be multiplied by the respective social cost of that greenhouse gas for that year found in the SC-GHG TSD. That is, methane emissions in 2022 should be multiplied by the SC-CH4 for 2022, not by the SC-CH4 that has been adjusted by a 2% inflation factor.

   TVA Response: Page 4 of the "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990" (SC-GHG TSD) first mentions that the interim SC-CO2, SC-CH4, and SC-N2O estimates are reported in 2020 dollars. Furthermore, Tables 1-3, and corresponding footnotes, indicate that all values in the document are in 2020 dollars. Therefore, TVA believes these estimates need to be adjusted to account for inflation.

7. The EPA reiterates our recommendation that TVA avoid expressing project-level GHG emissions as a percentage of national or state GHG emissions. The DEIS approach of comparing project-level emissions to national and state emissions diminishes the significance of substantial project-scale GHG emissions. This approach is also misleading given the nature of the climate policy challenge to reduce GHG emissions from a multitude of sources, each making relatively small individual contributions to overall GHG emissions. Instead, the EPA recommends that the FEIS include a discussion of whether and to what extent the estimated GHG emissions from the proposed alternatives are consistent with taking action to achieve science based national GHG reduction targets and any relevant state or local goals.

   TVA Response: The courts have approved the proxy methodology for analyzing GHG emissions from a proposed action, as provided in Section 3.7 of the DEIS. Since the current state of climate science does not allow for specific linkage between particular GHG emissions and particular localized impacts, the proportionate estimate of GHG emissions serves as a reasonable proxy for assessing potential climate impacts.

   Consistent with EPA's recommendation for other recent EISs, TVA has revised the FEIS to better describe how its action to retire coal-fired generation and the alternatives to replace that generation with less carbon-intensive sources helps achieve the GHG reduction targets discussed in the 2019 IRP and the TVA Strategic Intent and Guiding Principles Document (May 2021), as well as Administration goals. Additionally, TVA has followed EPA's recommendation in conducting a supplemental analysis comparing the

social cost of GHGs emitted under each alternative in Section 3.7, cognizant of the limitations of any such analysis due to uncertainties surrounding these social costs.

8. The EPA recommends the EIS explain why the TVA-wide GHG analysis considers a 20-year horizon to 2041 and whether this time horizon is sufficient to analyze trade-offs among emissions trajectories. Gas-powered combined cycle units had an average retirement age of 30 years in 2018, suggesting that a 20-year horizon is too short.[3] Conversely, the LCA uses a 30-year time horizon. To address this issue and related analytical shortcomings, the EPA recommends comparing the proposed projects' long-term generation impacts with energy use trajectories consistent with achieving science-based targets for GHG reduction. For example, a new natural gas-fired generating station could replace electricity generation from an existing coal-fired generating station in the near term, but lock in fossil fuel consumption for decades, forcing future trade-offs between now-existing natural gas generation and future renewable energy generation. As discussed above, the EPA recommends the EIS discuss how TVA will manage existing and proposed natural gas generation to achieve critical GHG-reduction goals. For important context, the EPA also recommends further explanation of TVA's plans for replacing the remaining lost capacity from retiring the Cumberland coal plant.

   TVA Response: Resource selection, and the overall portfolio in each alternative, is based on economics and accounts for the projected lifetime of each resource type. When selecting a resource, the capacity expansion model calculates each resource's cost over its lifetime. This allows comparison of resources that have different expected lifespans. Consistent with industry-standard IRP time horizons, TVA performs economic studies, such as the CUF Financial and Systems Analysis, over a 20-year period, and the GHG analysis is consistent with this. Forecasting production beyond a 20-year time horizon introduces significant uncertainties that jeopardize the accuracy of results.

   Based on comments received, TVA has included a life cycle analysis in the Final EIS which accounts for expected 30-year resource lifespans for the gas-fired units and a 20 year lifespan for solar and storage that is prorated to 30 years (see the GHG Effects from Direct and Indirect Emissions – Life Cycle Analysis discussions in Sections 3.7.2.3.1 and 3.7.2.5.1 in the Final EIS and Appendix H and Appendix I). As noted in Chapter 1 of the Final EIS, planning for the replacement generation for the second retired CUF unit would be deferred to allow additional time for the assessment of specific types and locations of that generation. Additional information provided in responses to Comment No. 38 (Carbon Trajectory) and Comment No. 42 (Asset Strategy) of the Response to Draft EIS Comments document.

9. In the LCA, upstream emissions are modeled as a one-time impact. However, the ongoing combustion of natural gas has upstream impacts from the natural gas. That should be included in the analysis.

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[3] "Average age of US power plant fleet flat for 4th-straight year in 2018", S&P Global https://www.spglobal.com/marketintelligence/en/news-insights/trending/gfjqeFt8GTPYNK4WX57z9g2

TVA Response: The ongoing non-combustion life cycle segment calculations include this information. Refer back to LCA Appendix and definition of these calculations.

10. The EPA recommends providing the rationale for the 1.5 prorating factor for prorating Alternative C to 30 years, as indicated on p.I-3 of Appendix I.

    TVA Response: Appendix I has been updated to explain that TVA typically models solar and battery storage as 20-year Power Purchase Agreements, and assumes operational time for solar panels/battery storage under Alternative C is 20 years. However, to provide a consistent life cycle comparison across all alternatives, the solar/battery storage alternative was prorated to 30 years by scaling up 20-year emissions by a factor of 1.5; 20 x 1.5 = 30.

11. In the LCA, costs for downstream emissions are assumed to occur in 2057, but other costs appear to only be calculated out to 2042. The EPA recommends providing further clarification regarding NPV calculation methodology.

    TVA Response: Section I.2 of Appendix I includes the following information:

    The system-wide lifecycle analysis builds off the assumptions presented above, while also considering net changes in generation supplied by the remaining TVA fleet on an ongoing basis as compared to the No Action Alternative for 20 years. Carbon dioxide emissions are pulled directly from TVA models, while nitrous oxide and methane emissions use factors based on annual electricity generation by resource type. One-time upstream emissions are assumed to occur in 2026, while one-time downstream emissions occur in 2057 (the first year following the 30-year asset life) and are discounted to the year 2042, which is the end of the 20-year study period. Ongoing annual combustion and non-combustion emissions are accounted for in the year emitted.

12. What values are used for SC-GHG beyond 2050, and what assumptions underpin them?

    TVA Response: SC-GHG values beyond 2050 were interpolated based on the rate of change from several years prior to and up to 2050. This is stated in the footnotes to the tables of SC values in Appendix I.

13. With regard to the following text from p.I-2 of Appendix I, "The life cycle emission factors in the NREL publications were only provided in terms of CO_2-equivalent emissions (in grams) per kilowatt-hour of electricity production. To disaggregate the CO_2-e emission factors into emission factors for each of the three individual GHGs, the individual GWP-weighted contributions of CO_2, CH_4, and N_2O to their total CO_2-e emission factors are prorated based on their relative contribution from the *USEPA Emission Factors for GHG Inventories, Table 6 - Electricity under Total Output Emission Factors for the eGRID Subregion of SERC Tennessee Valley*. These emission factors are 834.2 lb/MW-hr for CO_2, 0.075 lb/MW-hr for CH_4, and 0.011 lb/MW-hr for N_2O. Using these values, the percent contribution of CO_2, CH_4, and N_2O to the CO_2-e emission factor is 99.99%, 0.009%, and 0.001%, respectively. For the coal technology, this prorating was not

necessary as the NREL coal LCA publication provided the mean GWP-weighted contribution of CH_4 and N_2O to CO_2-e as approximately 5% and <1% (assumed 0.9%), respectively, so that the CO_2 contribution is 94.1%. The emission factors used for the LCAs are provided in Tables I.6.1 through I.6.4 for CO_2-e, CO_2, CH_4 and N_2O emissions, respectively.", please clarify the following:

A) Are there non-NERL sources to estimate non-CO2 emissions from electricity generation?
B) Is the TVA using TVA-wide emissions factors for natural gas generation, but different coal-specific emissions factors that have higher CH4 emissions?
C) Does natural gas generation produce higher CH4 emissions than coal?

TVA Response: TVA is not familiar with non-NREL sources for estimating non-CO2 emissions. The emissions factors used are from NREL sources and are fuel source specific. On a life cycle basis, the NG alternatives produce higher methane emissions than coal (No Action Alternative); however, the CO2 emissions from coal are overwhelmingly higher than CO2 from NG (by millions of tons/yr) and the total SC-GHG for coal is much higher than SC-GHG for NG alternatives.

14. With regard to the following text from Section 3.7, p.12: "Although all three alternatives would help achieve the Administration's goal of reducing emissions from overall federal operations, Alternative C likely would go further in achieving the goals outlined in EO 14057, targets agreed to in The Paris Agreement and national net zero policy", the EPA recommends that TVA identify how Alternative A will help meet the specific targets of E.O. 14057. Additionally, we recommend that TVA discuss how Alternative C will help to achieve the Paris target and national net-zero policy.

    TVA Response: This information has been added to Section 3.7 of the Final EIS.

15. Environmental Justice analysis of Section 3.7.2.2.1, p. 22 – the draft asserts there will be long-term minor positive effects due to improved air quality. To strengthen the EJ analysis, we recommend addressing whether emissions from the proposed natural gas plant will have a disproportionate impact on communities with EJ concerns. That could be because they not only experience higher levels of other pollutants, but also experience higher levels of non-pollution stressors that make them more susceptible to continued pollution.

    TVA Response: Section 3.7.2.2.1 of the FEIS has been updated to address this comment and provide additional details and analysis. Since certain EJ-qualifying census block groups exhibited elevated percentages of some environmental indicators, including particulate matter and air toxins, as compared with the state (and many nearby census block groups), and due to general proximity and assumed vulnerability due to non-pollution stressors, the experience of any adverse effects would likely be amplified for EJ groups as compared to non-EJ qualifying block groups generally farther from CUF.

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Appendix Q – Concentric Report – Response to Synapse and Goggin Reports

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ASSESSMENT OF THE DRAFT ENVIRONMENTAL IMPACT STUDY AND RESPONSE TO CERTAIN REPORTS

PREPARED FOR:
TENNESEE VALLEY AUTHORITY

OCTOBER 3, 2022

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ATTACHMENTS

Attachment A: Resume and Expert Testimony of William [Bill] R. Davis

REPORT SCOPE AND SUMMARY OF FINDINGS

Background

The Tennessee Valley Authority (TVA) is proposing to retire two coal-fired units at the Cumberland Fossil Plant (CUF). As part of an assessment of the environmental impacts of retiring the two coal-fired units and replacing the generation provided by one of the retired CUF units, TVA is preparing an Environmental Impact Statement (EIS) in which TVA is assessing various alternatives for replacement generation, including: Alternative A - Retirement of CUF and construction and operation of a combined cycle combustion turbine (CC) Gas Plant at the same site; Alternative B - Retirement of CUF and construction and operation of simple cycle combustion turbine (CT) Gas Plants at alternate locations; and Alternative C - Retirement of CUF and construction and operation of Solar and Storage Facilities, primarily at alternate locations.

The scope of this report is to assess the reasonableness of TVA's identification of Alternative A as the preferred alternative in its Draft EIS. Alternative A involves the retirement of the two CUF coal-fired units and the replacement of the generation of one unit with a 1450 MW CC plant. In addition, this report responds to Attachment 2 submitted by the Southern Environmental Law Center titled "Critique of TVA's Alternatives Analysis in the Utility's Cumberland Fossil Plant Retirement, Draft Environmental Impact Statement"' authored by Grid Strategies, LLC and dated June 13, 2022 (Grid Strategies report) as well as Attachment 1 submitted by the Sierra Club titled "Clean Portfolio Replacement at Tennessee Valley Authority" authored by Synapse Energy Economics, Inc. and dated May 2022 (Synapse report).

Summary of Findings

Observation #1: The Board Approved 2019 IRP provides a solid basis and analytic framework for future resource decisions. TVA's 2019 Integrated Resource Plan (IRP) serves as the backdrop for near-term and long-term resource additions that will build on TVA's existing diverse asset portfolio to ensure low-cost, reliable, and clean electricity for TVA customers into the future. The 2019 IRP included an analysis of a broad set of resources, portfolios, inputs, future worlds, and sensitivities to provide a robust view of possible future outcomes. The resulting long-term strategy involves the pursuit of up to 14 gigawatts (GW) of solar, up to 5 GW of storage, and 2 to 17 GW of natural gas generation by 2038.

Observation #2: The Cumberland retirement and resulting replacement resources represent an early step of a broader strategic plan. The evaluation of the near-term implementation measures to implement the strategy outlined in the IRP should be more about testing the consistency of the measures with the strategy as opposed to attempting to reset TVA's broad direction or decisions. There is general alignment about the retirement of the Cumberland facility as well as the need for future solar and storage; however, an important component of TVA's long-term plan to meet reliability and environmental mandates is the inclusion of both combined cycle and simple cycle

natural gas generators. Concurrent with the steps outlined in Alternative A and consistent with its 2019 IRP, TVA is completing a demand side management (DSM) market potential study, installing up to 8 GW of solar resources by 2028, deploying up to 2,400 megawatts (MW) of battery storage by 2028, and investing in transmission infrastructure, while working closely with its local distributors, to support higher penetration of renewable energy.

Observation #3: Long-term resource plans that exclude natural gas rely on overly optimistic assumptions. Focusing on narrow and optimistic long-term future assumptions about the cost and operation of still nascent technologies can have significant financial and reliability impacts. For example, lowering the assumed cost of renewable technologies results in an understatement of the cost of alternative "clean replacement" portfolios by more than $10 billion. Instead, as TVA did, resource portfolio strategies should be evaluated against a range of scenarios and critical input sensitivities to choose a target supply mix that achieves the desired objectives while mitigating risk.

Observation #4: Near-term deployment of combined cycle generation provides a solid foundation for aggressive renewable energy deployment. A diverse energy mix offers reliability and resilience and has proven to be particularly valuable during difficult operating conditions, like peak power demand during high summer temperatures or bitter cold during deep freezes. Recognizing industry studies have shown that the complexity of renewable integration escalates with the growing penetration of renewable energy, flexible and dispatchable natural gas resources will be a valuable part of TVA's resource portfolio to achieve its reliability requirements.

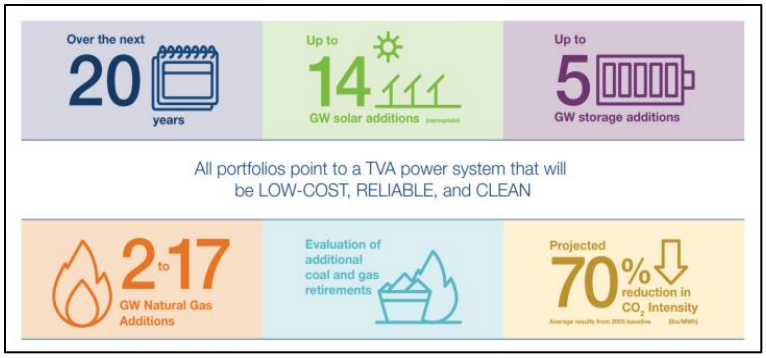
Conclusion: Alternative A is a practical and reasonable near-term implementation plan. There is alignment about the retirement of CUF and the need for replacement capacity. Adding natural gas combined cycle generation to the existing Cumberland site is an executable and reliable plan within the required timeframe. In contrast, orchestrating a symphony of assumed capabilities and costs of energy efficiency, solar, wind, and batteries along with the accompanying transmission upgrades is simply not a viable or rigorous approach as a near-term alternative that meets system reliability requirements. TVA's thorough and broad long-term planning consistently identifies the need for a diverse set of resources and load reduction measures, along with natural gas generation, solar and storage resources, with the amounts of each driven by future market conditions.

Supplemental Observation: The Inflation Reduction Act influences the amount and timing of resources within the ranges contained in the IRP. The comprehensive impacts of the Inflation Reduction Act (IRA) are uncertain and will take time to fully understand. Even so, questions about the effects of the IRA can be qualitatively assessed by considering whether the potential impacts would trend resource amounts higher or lower within the 2019 IRP ranges. While the IRA impacts must be more fully modeled and explored, fundamental concepts and conclusions will remain unchanged, such as the escalating complexity of adding renewable resources, the need for broad and rigorous analyses, and ultimately the need for dispatchable generation as part of a diverse and reliable generation portfolio.

OBSERVATION #1: THE BOARD APPROVED 2019 IRP PROVIDES SOLID BASIS AND ANALYTIC FRAMEWORK FOR FUTURE RESOURCE DECISIONS

The TVA 2019 IRP, as approved by the TVA Board, provides a roadmap to meeting forecasted energy demand using both supply and demand-side resources to ensure reliable service to customers in the most cost-effective manner. The plan outlines clear and achievable long-term goals and aspirations that will bolster TVA's potential to incorporate increasing amounts of renewable energy capacity and distributed energy resources. More specifically, it frames how TVA will offer low-cost and reliable electricity, facilitate environmental stewardship, and spur economic development over the next 20 years, all while ensuring system reliability. As shown below, TVA's study results underscore its commitment to a diverse portfolio that recognizes the inherent and unique tradeoffs associated with balancing competing priorities.

Figure 1: TVA's 2019 IRP Direction



The objective of the IRP process is to evaluate competing investment and purchase decisions to meet customer demand. The range of options available to utilities to balance supply and demand are expanding as new generation, load control, storage, and smart grid technologies become available and affordable. The characteristics of supply and demand resources are changing as well. Historically, load was viewed as a fixed obligation which utilities planned to meet with dispatchable supply. Higher penetration of intermittent generation and controllable loads mean that utilities must plan for a future in which both demand and supply behave in ways that are different from the past.

TVA's 2019 IRP reflects a robust evaluation of a diverse set of both supply-side and demand-side options to meet its customers' need for energy at the lowest cost over the forecast period, including environmental and economic costs. TVA employed a strategy combining investments and expenditures on traditional energy supply resources, distributed energy resources (DER), and comprehensive energy efficiency programs. These investments include diverse resources like renewables, battery storage, and DER, as well as more traditional supply-side resources that will be critical to ensuring grid reliability and resilience as new technologies emerge and mature.

Importantly, the IRP recognizes TVA's role as an environmental steward by outlining a roadmap by which TVA will dramatically reduce its greenhouse gas emissions over the next 20 years. The IRP shows that, by 2038, TVA will have reduced greenhouse emissions by an average of 70 percent from 2005 levels across all strategies studied. TVA's subsequent "Aging Coal Fleet Evaluation" (May 2021) and "Strategic Intent and Guiding Principles" (May 2021) build on the recommendations from the IRP and lay out TVA's current strategy to phase out its coal fleet by 2035, along with adding 10,000 MW of solar and leveraging new technology; all together supporting TVA's plan to 70% carbon reduction by 2030, development of a path to approximately 80% carbon reduction by 2035, and aspiration to achieve net-zero carbon emissions by 2050.

To achieve these objectives, TVA utilized a least-cost based analysis that weighed a range of future strategies to gauge how certain power generation portfolios and demand reduction measures could perform under a diverse array of external market and regulatory conditions. This analysis was informed by an IRP Working Group comprised of twenty members ranging from government officials to advocacy groups, each representing unique interests in the Tennessee Valley. Together, this group assisted TVA in designing five distinct strategies, employable across six different future scenarios, which resulted in thirty different alternative resource plans. This broad list of alternative resource plans laid the foundation for a robust analysis.

Based on TVA's mission of providing clean, dependable power to customers in the Tennessee Valley at a low-cost, TVA outlined five performance categories to evaluate resource plans. The performance categories included: Cost, Risk, Environmental Stewardship, Operational Flexibility, and Valley Economics. The figure below lists the five performance categories as well as the 14 different metrics used to measure the performance of each of the 30 different resource portfolios.

Figure 2: TVA's 2019 IRP Scorecard

IRP Scorecard Metrics		Low-Cost Reliable Power	TVA Mission Economic Development	Environmental Stewardship
Cost	PVRR ($Bn)	✓	✓	
	System Average Cost ($/MWh)	✓	✓	
	Total Resource Cost ($Bn)	✓		
Risk	Risk/Benefit Ratio	✓		
	Risk Exposure ($Bn)	✓		
Environmental Stewardship	CO2 (MMTons)		✓	✓
	CO2 Intensity (lbs/MWh)		✓	✓
	Water Consumption (MMGallons)			✓
	Waste (MMTons)			✓
	Land Use (Acres)			✓
Operational Flexibility	Flexible Resource Coverage Ratio	✓		
	Flexibility Turn Down Factor	✓		
Valley Economics	Percent Difference in Real Per Capita Income	✓	✓	
	Percent Difference in Employment		✓	

Each category is underpinned by complex analysis, which augments the broader evaluation. For example, TVA executed stochastic analysis to understand the risks and uncertainty within the planning assumptions for each portfolio. More specifically, Monte Carlo simulations were used to assess the multitude of possible futures and the relevant likelihoods. The Monte Carlo simulations, which are employed to emulate the probability of different outcomes in a model with multiple random variables, covered 16 input variables under four main risk categories. The evaluation of the scenarios' uncertainties takes into consideration the number of realistic future scenarios and the probability distribution tied to the expected forecasts. As a result, the probability distributions and ranges of the 16 variables were used to simulate a range of plausible outcomes at the 95th and 5th percentile, which provides important insight into the ranges of outcomes and risk trade-offs across all 30 resource plans.

The energy market and the macro environment are ever evolving and require ongoing planning and monitoring. The results of the IRP analyses indicate the most influential macro environment indicators on future resource plans, which include demand for electricity, natural gas prices, regulatory requirements, cost and performance of emerging technologies, customer expectations, operating costs of existing units, and the cost and performance of wind and solar. These indicators, or signposts, will impact the amount and timing of future resource decisions.

Summary

TVA's 2019 IRP represents both the analytical rigor and broad scope necessary to serve as the backdrop for near-term resource decisions that are consistent with the long-term strategy. Planning over a twenty-year horizon inherently relies on future projections for a multitude of modeling inputs and drivers. As TVA did, analyzing a broad set of resources, portfolios, inputs, future worlds, and sensitivities provides a robust view of possible future outcomes. TVA also measured its results against a meaningful set of performance metrics to clearly understand the trade-offs between resource portfolios and strategies across a set of scenarios. Broadening the analytical scope to include analyses of reserve margin, impacts of intermittent resources, and the benefits of flexible resources was highly relevant as TVA expects to be adding significant amounts of renewable energy. Including public input and working group input in the planning process is also an important element of a comprehensive planning process.

OBSERVATION #2: THE CUMBERLAND RETIREMENT AND RESULTING REPLACEMENT RESOURCES REPRESENT AN EARLY STEP OF A BROADER STRATEGIC PLAN

As part of its 2019 IRP and subsequent Aging Coal Fleet Evaluation, TVA evaluated the economics, reliability, portfolio fit, and environmental factors associated with its coal fleet. In furthering its analysis of the continued operation of its coal fleet, TVA determined that the first Cumberland unit should be retired as early as 2026, followed by the second unit as early as 2028. Coal plant retirements (and even the potential of early coal plant retirements) are entirely consistent with the direction of the 2019 IRP. In fact, the retirement of CUF is not disputed in the Grid Strategies or Synapse reports; instead, the reports take issue with how to replace the lost capacity from the CUF retirement.

Resource planning involves a series of tactical steps to implement the long-term strategy outlined in the IRP. At any given time, TVA is taking multiple actions to move along its long-term strategic path. For instance, TVA is completing a DSM market potential study, deploying up to 8 GW of solar by 2028, deploying up to 2,400 MW of battery storage by 2028, investing in transmission infrastructure to support higher penetration of renewable energy, as well as taking steps to support the addition of natural gas generation. During implementation, signposts are monitored for material shifts in critical IRP inputs then, ultimately, the process repeats with a full-scale check-in on progress and direction in the next IRP.

Therefore, the evaluation of near-term implementation steps, such as the replacement of CUF capacity at issue here, should be more about testing the consistency of the replacement plan with the strategy outlined in the 2019 IRP instead of attempting to reset the broader direction or decisions. In fact, many of the arguments in the Synapse report and Grid Strategies report represent fundamental differences in future industry characterizations and resource alternatives already explored by the 2019 IRP. The Synapse report, Grid Strategies report, and TVA's 2019 IRP all support the adoption of large amounts of solar and batteries. In contrast though, an important component of TVA's plan to meet system reliability needs at lowest cost is the inclusion of both combined cycle and simple cycle natural gas generators. More precisely, the elemental disagreement at hand is the need for new dispatchable generation. While both the Synapse and Grid Strategies reports suggest large amounts of renewable resources can be added to the system without impacting system reliability and resilience, TVA appropriately recognizes that increasing the amount of intermittent generation and resources based on emerging technologies will require dispatchable generation to ensure that customer energy and capacity needs are met around the clock. Given the significant amount of solar, battery storage, and DER expected in the medium-term, it is prudent for TVA to deploy new

dispatchable generation by the time the two CUF units are retired at the end of their lives in 2026 and 2028.

The following sections of this report explore the areas where the Synapse report and Grid Strategies report disagree with TVA's assessments and direction. Based on a review of both reports, retiring CUF and selecting Alternative A represent reasonable near-term implementation steps entirely consistent with TVA's broader direction and analytic conclusions as outlined in the 2019 IRP.

OBSERVATION #3: LONG-TERM RESOURCE PLANS THAT EXCLUDE NATURAL GAS RELY ON OVERLY OPTIMISTIC ASSUMPTIONS

Even though the Synapse report, Grid Strategies report, and TVA's 2019 IRP all support the adoption of large amounts of solar and battery resources, there are fundamental differences in the assumed capital and operating costs of generating resources, as well as the expected contributions of these resources to system reliability and resiliency. To set the strategic direction outlined in the 2019 IRP, TVA evaluated six different strategies across five different future world scenarios, varying the ranges of 16 inputs, assessing 14 different performance metrics, and then evaluating 10 additional sensitivities. In contrast, the Synapse report modeled two scenarios by strategically adjusting input assumptions that drive additional adoption of solar, storage, energy efficiency, behind-the-meter resources, and wind. Conversely, the Grid Strategies report presented a narrow version of a lifetime cost analysis by substituting certain resource characterizations with more optimistic assumptions.

The Synapse report and Grid Strategies report include assumptions about critical inputs to the IRP analysis that are optimistic when compared to publicly available data: the availability of low-cost wind imported into the TVA service territory via inter-regional transmission projects, low-cost energy efficiency measures, and unlimited operational flexibility of battery storage resources. The points directly below highlight how using alternative and more realistic assumptions would impact the conclusions of the Synapse and Grid Strategies reports.

Wind

TVA does not include the addition of onshore wind resources in its 2019 IRP due to its high capital cost, while the Synapse report includes the addition of over 3,600 MW by 2030 and a total of 5,400 MW of wind by 2042 via imports from the Midcontinent Independent System Operator (MISO) and the Southwest Power Pool (SPP). The Grid Strategies report and Synapse report assert that the reason for this difference in the projected addition of wind resources is caused by TVA's overestimation of capital cost estimates for onshore wind. In its 2019 IRP, TVA used $1,807/kW[1] for the MISO and SPP regions ($1,904/kW for the Tennessee Valley) based on actual completed wind project costs in 2016 in the Interior region of the United States[2]. Importantly, for MISO and SPP wind projects, TVA also included the cost of interconnection, including network upgrades, of $192/kW[3] resulting in overnight costs without interconnection costs of $1,615/kW. This estimate is very similar to the 2020 National Renewable Energy Laboratory (NREL) Annual Technology Baseline (ATB)

[1] 2019$ escalated using 1.8% inflation adjustment from the 2016$ source data
[2] U.S. Department of Energy's 2016 Wind Technologies Market Report, Figure 44
[3] 2019$

estimate of $1,605/kW[4]. Subsequently, the 2021 NREL overnight wind cost estimates dropped to $1,376/kW[5] based on its modeling of the underlying components for a generic wind project. In stark contrast, the U.S. Department of Energy's 2022 Land-Based Wind Market Report showed costs of wind for SPP and MISO of $1,500/kW and $1,600/kW[6] respectively, based on actual 2021 completed project costs. These comparisons demonstrate both the reasonableness of TVA's cost estimates and the importance of analyzing a range of inputs as TVA did. If the 5,400 MW of wind modeled in the Synapse report reflected more reasonable cost estimates and interconnection costs, the additional overnight capital cost would have increased by $2.3 billion.[7]

In addition to the capital cost differences, the Grid Strategies report and Synapse report fail to recognize the difficulty in building inter-regional transmission projects to move wind output from its source to load centers. These resource intensive projects tend to have lengthy planning, approval, and implementation timelines. The Grid Strategies report reference to the Southern Cross transmission line is an excellent example of the challenges and high cost of building inter-regional transmission. The cited news article indicates that the Southern Cross project[8] will cost $2 billion with 2,000 MW of capacity, or $1,000/kW for the cost of transmission alone. Interestingly, the article referenced by the Grid Strategies report also notes that even if the project starts in 2023 and is completed in 2026 it will have been 17 years from conception to completion. While improvements in inter-regional transmission planning are promising, optimistically assuming readily available transmission capacity to import wind from neighboring regions as replacement capacity for the retirement of CUF is not realistic.

Importantly, TVA's 2019 IRP included a sensitivity case to assess the impact of low-cost wind. Assuming a cost of roughly half the base case, TVA's sensitivity analysis showed that 4,200 MW of wind could be economical and displace 3,100 MW of solar generation by 2038. The 2019 IRP analysis of wind provided the key conclusion that if wind costs decline significantly compared to alternative resource options and there is access to a higher wind capacity factor, then wind can be a viable replacement for future capacity retirements. At this time, however, onshore wind is not economic compared to alternative resources. Therefore, TVA is focused on the near-term addition of up to

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4 Based on the average of Class 4 and Class 6, the NREL wind overnight costs also excluded transmission interconnection costs

5 2019 cost estimate in 2019$, from NREL's 2021 Annual Technology Baseline

6 2021$

7 This is a conservative estimate based on 2019 costs. TVA's 2019 IRP modeled wind costs increasing at a rate moderately below inflation while NREL cost forecasts decline significantly over the planning horizon. These differences in expected future costs would result in a larger capital cost difference in future years.

8 The Southern Cross transmission project is proposed to be a 400-mile high-voltage direct current line from Texas through Louisiana and Mississippi to western Arkansas

8,000 MW solar by 2028, 2,400 MW of battery storage by 2028, and adding dispatchable gas generation to prepare the system for higher levels of renewable energy.

Energy Efficiency

By 2028, TVA's demand-side resource portfolio is expected to include up to 1,800 MW of peak reduction capabilities. However, the Synapse and Grid Strategies reports argue that more savings are available at a low cost. The Grid Strategies report assumes the costs of energy efficiency will be $10-$25/MWh[9] while the Synapse report assumed a cost of $27/MWh[10]. Neither the Grid Strategies report nor the Synapse report provide specifics about which end use measures or delivery mechanisms could be used to achieve future energy savings and instead rely on broad expectations based on backward looking data references. Contrary to those assumptions, historical energy efficiency performance and costs are not a reliable indicator of the future. As low cost and low investment measures are exhausted, such as light-emitting diode (LED) lighting, and other efficiency building codes and appliance standards usurp utility energy efficiency offers, future utility programs are likely to be much more costly with fewer savings than historically experienced.

The Synapse report incorporated two major assumptions regarding energy efficiency into its modeling with regards to the Clean Portfolio Replacement scenario. First, the assumption about the highest adoption case of behind-the-meter solar and storage and second, the inclusion of an energy efficiency portfolio reaching and maintaining 1% incremental annual energy savings. For the behind-the-meter solar and storage impacts, the Synapse report relied on TVA's 2019 IRP estimates, but it appears the Synapse report did not include the cost to drive those levels of adoption. Importantly, TVA's 2019 IRP estimates of behind-the-meter solar and storage adoption rely on TVA providing programmatic incentives to participating customers which cover the full incremental cost of the installations. The present value of those costs over the planning period total $479 million, a meaningful amount assumed away in the Synapse report.

Next, for the assumptions about future energy efficiency savings and costs, the Synapse report relied on a study covering 2011-2017 to support its cost estimates and a study of 2020 utility program performance to support its future energy savings targets. A mainstay of historical utility energy efficiency programs was compact fluorescent lamp (CFL) and LED lighting upgrades. However, electric utilities are now competing with market transformations and federal efficiency standards for future energy savings. That trend will also likely impact commercial lighting savings from LEDs. In fact, the IRA allotted $1 billion to assist the adoption of more efficient building codes; a change that would significantly reduce future savings opportunities for utility-sponsored energy efficiency programs. Energy savings outside the lighting category tend to have higher rebates as well as higher

[9] Grid Strategies report, page 29
[10] Synapse report, page 30

out-of-pocket matches from participating customers. Furthermore, if utilities continue to allocate more energy efficiency resources towards disadvantaged communities, then the future costs of savings will be significantly higher as those program designs include significantly higher rebates and are not necessarily required to be cost effective. Connecticut is a concrete example of a recently approved energy efficiency plan[11] to demonstrate this point. Connecticut has been rated in the top 10 on the American Council for an Energy Efficient Economy's scorecard for more than a decade. Importantly, Connecticut's most recently approved electric energy efficiency plan for 2022-2024 includes annual savings of 0.7% of load with a first-year cost of $1.05 per kWh. The Synapse Clean Replacement Portfolio scenario assumed energy savings would begin at 0.1% of load and ramp up to 1% by 2035. Being conservative and starting with $0.2225 per kWh first-year cost[12] and ramping up to and continuing at an inflation adjusted[13] $1.05 per kWh first-year cost in 2032 (when annual savings reach 0.7% of load) would increase the planning horizon present value cost to Synapse's Clean Replacement Portfolio by $8.1 billion[14] and would result in an *annual* budget of $2 billion in 2035 to achieve 1% savings, which would then continue in perpetuity.

The Grid Strategies report made similar assertions about the availability of low-cost energy efficiency. To support its levelized cost range of $10-$25 per MWh for energy efficiency, the Grid Strategies report referenced a figure in TVA's 2019 IRP. While it is true TVA's estimates for commercial and industrial energy efficiency costs are within the levelized $10-$25 per MWh range, it is also true the residential energy efficiency levelized cost range exceeded $250 per MWh, a fact the Grid Strategies report failed to acknowledge. Moreover, the amount of savings available at those cost levels in TVA's 2019 IRP was constrained to reflect adoption limitations with the underlying delivery strategies and incentive levels. This point was entirely ignored by the Grid Strategies report, which referenced the same source as the Synapse report to support the assertion that more energy efficiency savings were readily available.

In response to feedback during the 2019 IRP process, TVA analyzed a sensitivity case of adding significantly more energy efficiency and demand response. The analysis indicated that about 2,100 MW of additional demand-side resources were economically reasonable compared to the base case if higher volumes could be realized at the assumed costs. In the model, the additional demand-side resources displaced about 2,200 MW of solar and about 2,000 MW of combustion turbine capacity. The overall results showed a similar lifetime cost, higher system average cost, and 10 percent lower

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11 https://portal.ct.gov/-/media/DEEP/energy/ConserLoadMgmt/Final-2022-2024-Plan-to-EEB-1112021.pdf

12 The equivalent first year cost per kWh for the levelized cost of 2.7 cents per kWh, using an 8% discount rate (consistent with TVA's 2019 IRP) and 12-year useful life (consistent with the Synapse report)

13 Assuming 2.5% inflation

14 Assumes the Synapse report multiplied the annual cumulative savings by $0.027 per kWh for each year of the planning horizon

carbon emissions. The sensitivity case clearly demonstrated the amount and cost of the demand-side savings is an important factor that will drive the amount of future resources needed, which is also why TVA is actively conducting a market potential study to inform the future of its energy efficiency and demand response portfolio.

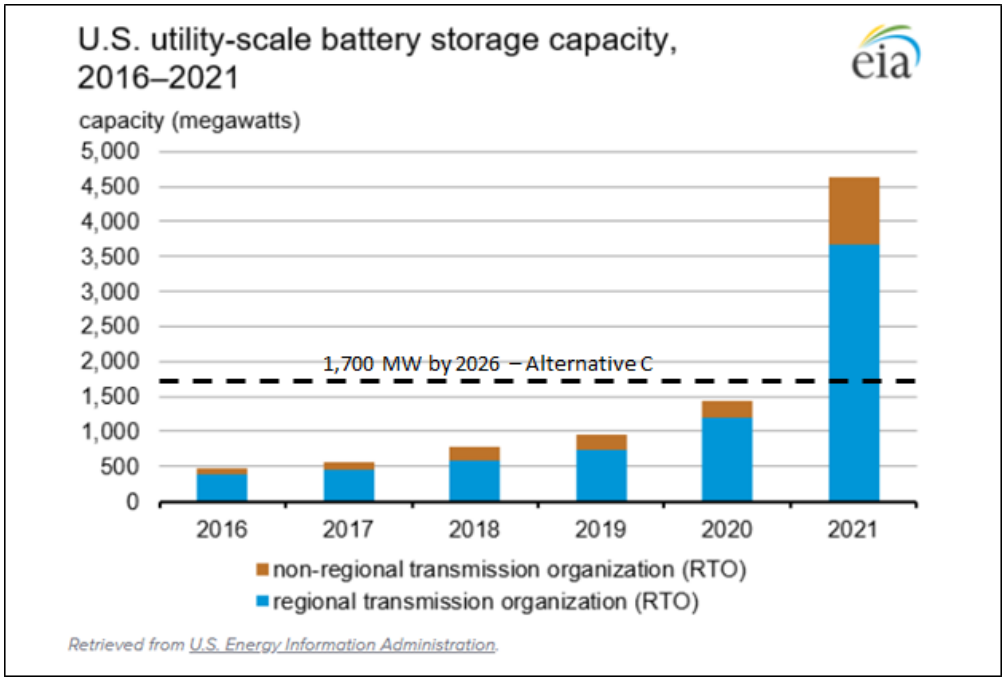
Storage

Storage is a meaningful element of TVA's future resource additions. The 2019 IRP range includes battery storage up to 2,400 MW by 2028 and up to 5,300 MW by 2038 (depending on technology costs, performance, and load growth). The Grid Strategies report characterizes batteries as a resource akin to a baseload generating resource capable of providing baseload energy and capacity across a majority of hours, while the Synapse report adds 32,000 MW of battery storage plus nearly 30,000 MW of solar in the Solar/Storage Replacement scenario. To put this in context, the 2042 TVA winter peak with reserve margin is roughly 40,000 MW being served by 29,100 MW of other generation resources (nuclear, gas, hydro, and behind-the-meter solar) and the Synapse model needed an additional 30,000 MW of solar and 32,000 MW of battery storage to meet the energy and demand needs of the system; meaning there would be 91,100 MW of nameplate capacity to serve 40,000 MW of peak winter demand.

While battery storage is making technological advancements, industry understanding and modeling of how large amounts of battery storage will impact the grid is based on limited experience. In 2019, the U.S. Energy Information Administration indicated there was a total combined battery storage capacity of about 1,000 MW which grew to 1,500 in 2020 and then to over 4,500 in 2021.[15] As part of Alternative C, adding 1,700 MW of storage by 2026 for the CUF retirement would result in TVA adding, owning, and operating more battery storage capacity over the next 4 years than the entire United States had in 2020. The figure below illustrates how historical battery storage adoption across the U.S. compares to Alternative C and gives further context to the already significant battery storage ranges in TVA's 2019 IRP.

[15] Data from the *Annual Electric Generator Report*

Figure 3: EIA U.S. Utility-Scale Battery Storage Capacity 2016 - 2021



In assessing the economics of adding battery storage to the TVA portfolio of resources over the twenty-year forecast period, the Synapse report relied on NREL's battery storage costs estimates. In characterizing battery storage, NREL selected a fixed operations and maintenance expense (FOM) for battery storage and assumed it would be sufficient to maintain the battery's design capacity over its useful life. However, NREL noted: "If the battery is operating at a much higher rate of cycling, then this FOM value might not be sufficient to counteract degradation."[16] This highlights the uncertainty inherent in the Synapse report's conclusions and undermines the Grid Strategies report assumptions about the long-term capabilities of batteries. As an analogy, consider tips and guidance on how to prolong the life of an electric vehicle battery. A recent AAA article recommended the following practices to prolong vehicle battery life: opt for slow charging, when possible, keep the battery charge comfortably above zero, limit how often you fully charge the battery, and pay attention to the battery temperature[17]. These electric vehicle operation strategies differ moderately across vehicle manufacturers, but they all support the common conclusion that how batteries are used and charged directly impacts performance and longevity.

[16] Cole, W., Frazier, A., Augustine. *Cost Projections for Utility-Scale Battery Storage: 2021 Update.* NREL. June 2021. https://www.nrel.gov/docs/fy21osti/79236.pdf.

[17] https://mwg.aaa.com/via/car/how-extend-life-electric-vehicle-batteries

NREL's 2038 'Moderate' estimate for FOM expense for a 4-hour capable battery is about $28 per kW year (in 2038$[18]), which means the annual FOM expense for 32 GW of batteries in 2038 from Synapse's Solar/Storage Replacement scenario would be $902 million. To understand the uncertainty of FOM alone, it is important to understand NREL's FOM cost estimate is assumed to be a static 2.5% of the battery cost in each of NREL's FOM scenarios and instead the FOM ranges vary proportionally with capital cost.

While battery storage has the potential to provide important system benefits, neither the Synapse report or Grid Strategies report appear to consider battery performance specifications and/or specify a technology. Battery storage technology and performance factors are critically important to system reliability and stability. For instance, a battery's useful life is impacted by the number of times it is cycled (i.e., how many times it is dispatched) and the depth of those discharges (i.e., how much of its capacity is used when it is dispatched). It is logical to assume that as the more battery capacity is relied upon for peak load needs and system reliability needs, they will experience more cycles and deeper discharges. In particular, the Solar/Storage Replacement scenario from the Synapse report would rely heavily on batteries for peak loads and system reliability needs.[19]

The figure below directly illustrates the FOM risk of reducing battery storage life through increased operational use. NREL assumes a 2.5% annual FOM expense which implies over the 15-year life of the battery, 37.5% of it has been replaced at some time during its life (conservatively assuming 100% of the FOM dollars go to new battery cells). The figure below shows how the FOM expenses increase relative to the base of 37.5% up to replacing 100% of the battery over its 15-year life. It is apparent for the Solar/Storage Replacement scenario, which includes 32 GW of battery storage, the FOM uncertainty alone could increase the costs of the scenario materially.

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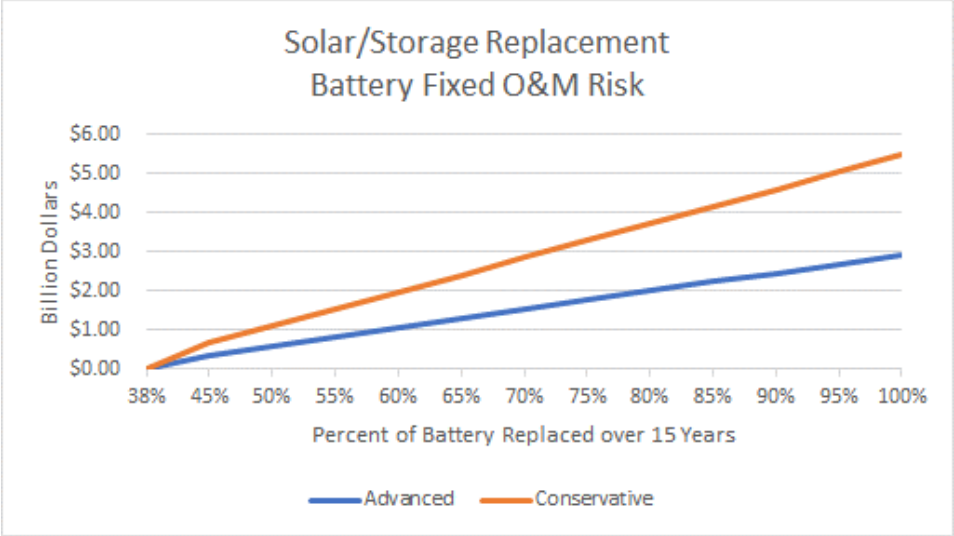
[18] NREL's 2021 Annual Technology Baseline provided utility scale battery storage costs in 2019$. The 2019$ amount is about 18 per kW and applying an annual 2.5% inflation factor results in about $28 per kW.

[19] The Synapse report appears to assume running a base case portfolio through a production cost model that solves for enough resources, including imports, is sufficient to support a statement that the scenario provides the same level of reliability as portfolios with natural gas generation. Such a conclusion must rely on side-by-side stress testing of the portfolios with variations in inputs as well as assessing performance metrics beyond the present value of revenue requirements.

Figure 4: Battery Fixed O&M Expenses, Advanced and Conservative Cases



Summary

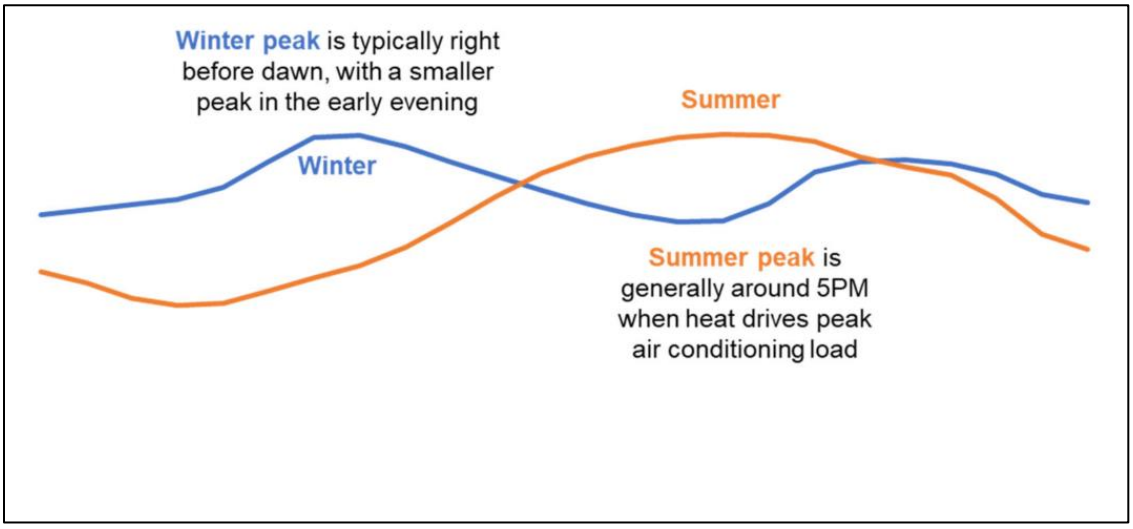
Cost-effective future resource plans that exclude natural gas rely on compounding assumptions, which are favorable yet unrealistic. This section highlights the need to evaluate a range of resource portfolio strategies over iterations of future scenarios with a multitude of critical inputs and sensitivities, and then evaluate the performance using pertinent metrics. Strictly focusing on idealized long-term future assumptions is not a persuasive methodology to reset TVA's overall resource direction and strategy, which is methodically outlined in its 2019 IRP.

OBSERVATION #4: NEAR-TERM DEPLOYMENT OF COMBINED CYCLE PROVIDES A SOLID FOUNDATION FOR AGGRESSIVE RENEWABLE ENERGY DEPLOYMENT

A reliable flow of power to our electricity grid is no longer the only measure by which customers assess the performance of their electric utility. Customers are increasingly demanding that electricity supply be both reliable and clean. Adding solar and wind resources achieves environmental objectives, but when the sun isn't shining or the wind isn't blowing, other types of generating resources are needed to maintain critical grid reliability. A diverse energy mix offers reliability and resilience, which has proven to be particularly valuable during difficult operating conditions, such as peak power demand during high summer or bitter cold during deep freezes. The optionality offered by a diverse portfolio of generating resources also supports affordability. Should the price of one fuel spike, or should bad weather compromise the supply of one power source, another lower cost option can be substituted, holding down energy prices for consumers.

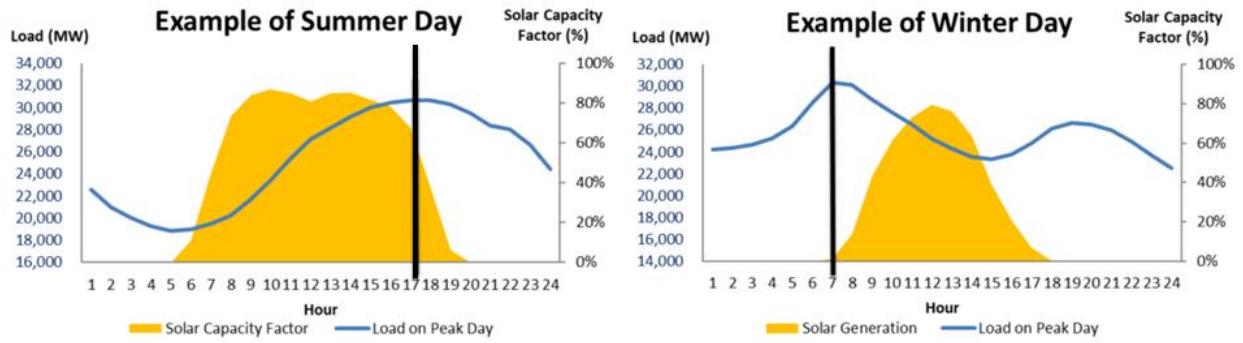
In operating a reliable system, the goal is to have enough capacity available to meet peak demand. As shown in Figure 5 below, the TVA winter peak occurs at approximately 7am, while the TVA summer peak occurs at approximately 5pm.

Figure 5: TVA Winter and Summer Peak Day Load Profiles



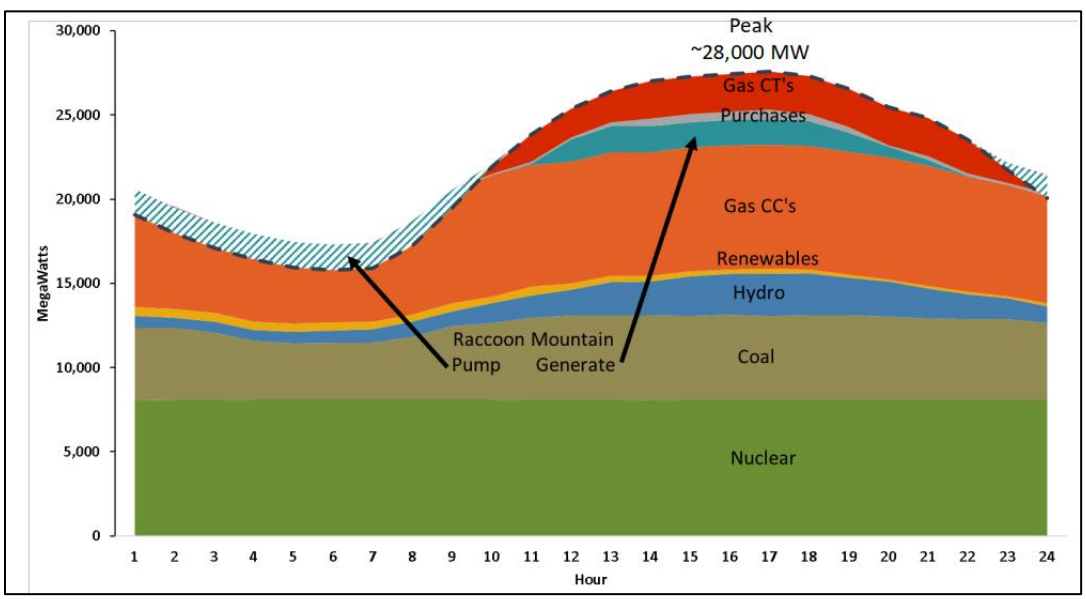
As can be seen below, solar output is declining as the summer peak hour approaches; and, although solar output increases later in the morning during the winter, it is completely unavailable for the near peak pre-dawn loads.

Figure 6: Solar Output on Peak Summer and Winter Days



Wind output also mismatches with these peak loads, with summer wind output at 14% of its capacity at the time of summer peak and 31% of its capacity at the time of winter peak. This mismatch in solar and wind output compared to peak demand requires that other resources, including nuclear and fossil resources, be available for dispatch to meet peak demand. As shown below, TVA dispatches its diverse generating fleet of nuclear, coal, gas, hydro, and renewables by both availability and cost. In the lower load hours, these resources are sufficient to meet customer demand. However, in the peak hours, gas fired units are crucial in meeting peak demand in the summer and winter.

Figure 7: TVA Load Dispatch on a Typical Summer Day



The broader industry has been exploring the place wind and solar have in the evolving grid. Importantly, there is no bulk power system operating today with significant penetration of wind and solar resources, limiting the ability to learn from others. These resources differ from fossil and

nuclear generation in that their ability to produce power is dependent on the weather, which creates uncertainty in terms of their availability. Also, these machines' electrical properties are unique from those traditionally built in that they are inverter based (i.e., electronically connected to the grid rather than mechanically connected).

Due to environmental mandates requiring "clean" generating resources by a certain date, and the uncertainty around the impact of a high penetration of zero-emitting generating resources on the power system, system operators have conducted highly detailed studies to explore how wind and solar growth would affect reliability and resiliency. These studies, as further described below, have shown that the complexity of renewable integration escalates with the growing penetration of renewable energy, requiring significant physical and operational changes to the bulk power system. Over some renewable penetration ranges, complexity is constant when spare capacity and flexibility exist. However, at specific penetration levels, complexity rises dramatically as the excess capacity and flexibility are exhausted. These represent system inflection points, where the underlying infrastructure, system operations, or both need to be significantly modified to reliably achieve the next tranche of renewable deployment.

MISO undertook an assessment to systematically find system integration inflection points driven by increasing renewable integration.[20] The MISO assessment found that when the percentage of annual load served by renewable resources is less than 30% system-wide, the integration of wind and solar faces challenges but appears manageable with significant changes to transmission expansion, operating, market, and planning practices within the existing framework. Above the 30% level, significant system-wide complications arise, driven by the increased variability of wind and solar, changes in resource availability, and an overall lack of transmission capacity in the region. Addressing these complications through system upgrades and operational changes can enable the grid to be operated reliably with up to 50% of the energy served by wind and solar resources.[21]

In addition, NREL conducted a study to analyze the effects of increased wind and solar penetration on the operation of the bulk power system and found that estimated U.S. electricity demand in 2050 could be met with 80% of generation from renewable electricity technologies with varying degrees of dispatchability. However, this amount of renewables generation on the system would require a mix of flexible conventional generation and grid storage, additional transmission, more robust load response measures and changes to power system operations. While this analysis suggests such a high renewable generation future is possible, a transformation of the electricity system would need to occur to make this future a reality. This transformation would involve every element of the grid, including adequate planning and operating reserves, increased flexibility of the electric system,

[20] MISO's Renewable Integration Impact Assessment Summary Report, February 2021.
[21] Id., page 13.

expanded multi-state transmission infrastructure, development and adoption of technology advances, new operating procedures, evolved business models, and new market rules.[22]

TVA's Planning Incorporates the Dynamic Impacts of Increasing Renewables

In order to underpin TVA's 2019 IRP to understand detailed system outcomes under a wide range of operating conditions, Astrapé was retained to build and run the Strategic Energy and Risk Valuation Model (SERVM) model to assess reserve margin and loss of load impacts from the addition of increasing level of renewables on the system. The model reflects more than 30 years of historical load and weather relationships, demand-side resource operating constraints, details about the operating capabilities of TVA's existing supply-side generation resources, weather impacts on hydroelectric generation capabilities, ancillary service requirements, specific operating reserve requirements, as well as import and export constraints for 20 zones of neighboring systems. The model is capable of hourly and sub-hourly simulations providing rich insights to real-world operational outcomes.

Beyond reserve margin analysis, loss of load modeling in SERVM is a useful methodology to determine capacity levels needed from renewable resources because it accounts for the dynamic effects of adding renewables while ensuring overall reliability targets are achieved. In fact, the capacity levels of solar and storage needed in Alternative C were modeled using this approach. First, TVA modeled the solar capacity needed to replace the lost generation from a retired CUF unit which resulted in 3,000 MW of solar capacity with a 22% capacity factor to replace the CUF generation.[23] Then, the SERVM model was run with the 3,000 MW of solar to determine the level of battery storage needed to maintain the industry reliability standard of a one-day-in-ten years loss of load event, resulting in 1,700 MW of battery storage capacity needed. In contrast, the dynamic reliability effects of adding a dispatchable combined cycle plant are expected to be less than adding increased renewables resources and the loss of load modeling is not a necessary step to determine the combined cycle capacity amount. Further, combined cycle units have much larger ranges of modularity than renewable resources and it was determined a two-unit combined cycle plant with a 1,450 MW capacity would be sufficient to meet reliability requirements. For instance, the next capacity increment of a combined cycle plant would be another 725 MW, far more than the amount needed. Finally, combined cycle units do not have the same energy limitations as batteries, which have typical durations of 4 hours. Combined cycle units can run across many hours and days to support prolonged periods of high loads, which reduces relative risk for a loss of load event.

The Grid Strategies report highlighted concerns about the addition of combined cycle generation to replace the retired CUF generation in terms of natural gas reliability and correlated outages. In fact,

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[22] National Renewable Energy Laboratory Renewable Electricity Futures Study, 2012.

[23] Note the Draft EIS stated 'approximately 25%' while the underlying analysis reflected a 22% capacity factor based on TVA's system experience with existing solar resources.

TVA's natural gas generating fleet has several advantages that mitigate the risk of fuel supply outages in its natural gas generating fleet. According to TVA's 10-K filing for the fiscal year ending September 30, 2021:

- 80 of TVA's combustion turbines (about 80%) were dual-fuel capable, and TVA has fuel oil stored on each of these sites as a backup to natural gas.
- Transportation of natural gas occurs across nine separate pipelines, with approximately 66 percent being transported on two pipelines.
- Approximately 1,517,000 million British thermal units is maintained per day of firm transportation capacity on seven major pipelines, with approximately 59 percent of total firm transportation capacity being maintained on two pipelines.
- TVA utilizes natural gas storage services at seven facilities with a total capacity of 7.25 billion per cubic feet (Bcf) of firm service and 5.00 Bcf of interruptible service to manage the daily balancing requirements of the nine pipelines used by TVA, with approximately 59 percent of the total storage capacity being maintained at two facilities. During 2021, storage levels were generally maintained at between 40 and 80 percent of the maximum contracted capacity at each facility. As TVA's natural gas requirements grow, it is anticipated that additional storage capacity may need to be acquired to meet the needs of the generating assets. In 2022, TVA expects to increase its storage portfolio by approximately 10 percent.

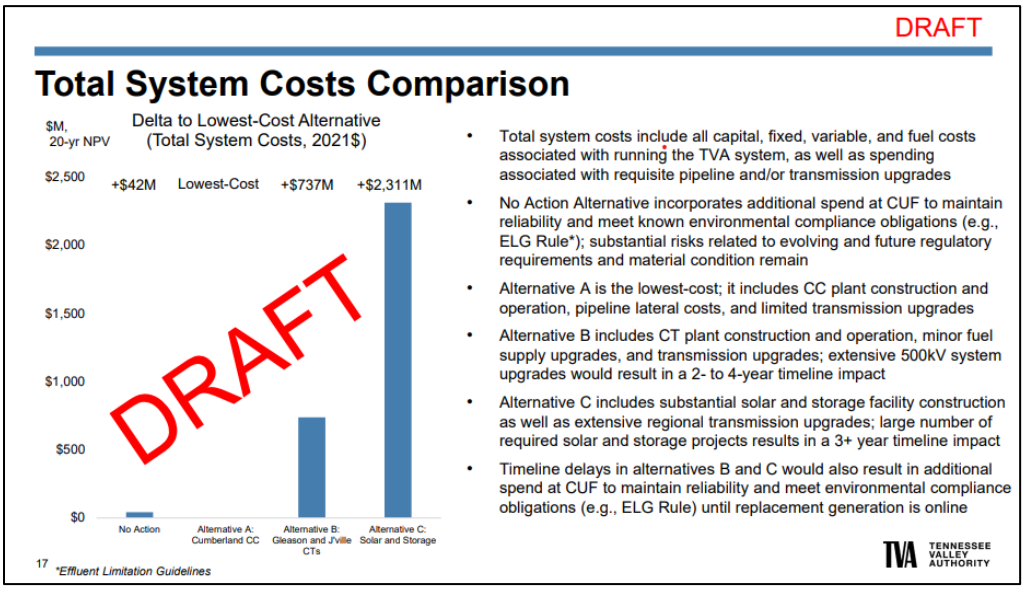
Summary

A diverse generation portfolio offers reliability and resiliency benefits and is particularly valuable during challenging operating conditions, like peak power demand during high summer temperatures or bitter cold during deep freezes. Industry studies have shown that the complexity of renewable integration escalates with the growing penetration of renewable energy. Flexible and dispatchable resources will be critical to meeting system reliability and resiliency needs, as TVA increases the renewable resource capacity on its system. Near-term deployment of combined cycle generation under Alternative A provides a solid foundation for aggressive renewable energy deployment while accelerating the retirement of TVA's coal fleet.

CONCLUSION: ALTERNATIVE A IS A PRACTICAL AND REASONABLE NEAR-TERM IMPLEMENTATION PLAN

The retirement of the CUF unit is not controversial. Instead, the issues are about how much and what types of replacement capacity should be used. The figure below shows the lifetime cost differences between the alternatives presented in the Draft EIS. It is apparent Alternative A is the least-cost outcome while conversely Alternative C is the costliest alternative. A significant value driver of Alternative A is that it can be implemented quickly, resulting in an earlier retirement of CUF and displacement of more costly generation resources serving load. The following discussion contrasts the implementation characteristics of Alternative A and Alternative C, which supports the modeling timelines within the figure below.

Figure 8: Cost Comparison of Alternatives[24]



Feasibility of Alternative A

Alternative A includes a proposed combined cycle plant at the existing Cumberland site which allows for a readily available transmission interconnection and requires a 32-mile natural gas pipeline extension. The site work would begin in 2023 while the physical construction would begin in the fall of 2023 with commercial operation as early as the summer of 2026. Alternative A was identified as TVA's preferred alternative in the Draft EIS in part because it has several factors that reduce execution risk; some of which center around the Cumberland Reservation being an existing

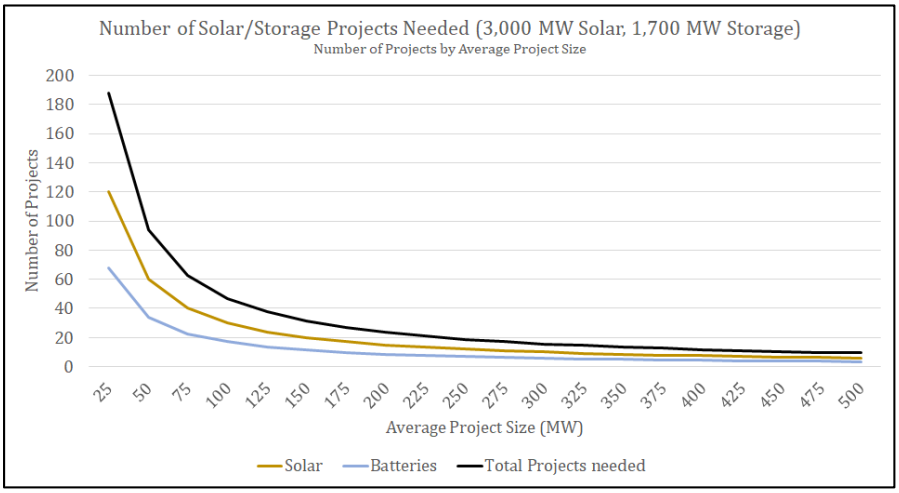
24 https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/environment/cuf_eis_alternativesevaluation_20220423-vfinal21a071b9-0fd1-4a8a-841a-8d9e74ba3ba5.pdf?sfvrsn=a7efe477_5

brownfield generation site. The brownfield location allows for repurposing existing resources and infrastructure while concurrently avoiding the need to supplement the existing transmission once CUF is shuttered. It is noteworthy that combined cycle natural gas plants are a mature technology with 42 GW installed from 2015 through 2022 in the United States.[25] Alternative A would certainly reflect the risks of typical major construction projects; even so, the project timelines and scope appear to be achievable given general expectations about how long it takes to complete a project of this nature.

Feasibility of Alternative C

Alternative C requires 3,000 MW of solar plus 1,700 MW of battery storage. In this alternative, the specific projects and accompanying locations to provide the necessary capacity are not known at this time. Further, it is unknown how many projects would be needed because the size of each project can vary with its location and design. To illustrate the challenge, the figure below shows the number of projects needed based on average project size. TVA's current interconnection queue for solar and storage indicates an average project size of 138.5 MW which would require 34 projects to achieve a combined 4,700 MW of solar and storage capacity. In addition, even if the average project size is larger, the number of projects implemented could be higher because the portfolio of projects could be comprised of many smaller projects along with a few much larger projects. To complicate the task further, each of the projects would have unique project development timelines, studies, and environmental impacts.

Figure 9: Solar and Storage Projects Needed for Alternative C

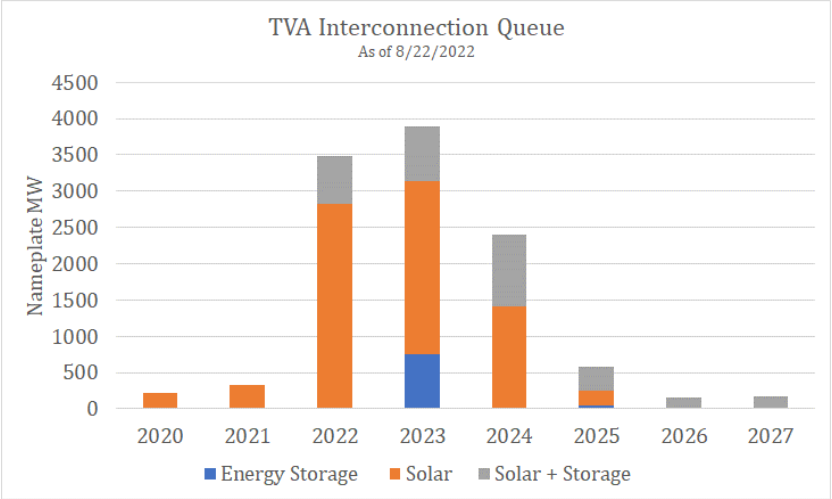


The backdrop for near-term decisions is TVA's 2019 IRP and strategic direction outlined in the subsequent Strategic Intent and Guiding Principles (May 2021) document, so it is important to consider TVA's broader plan to add up to 10,000 MW of solar by 2035, complemented with storage.

[25] U.S. Energy Information Agency, Electric Power Annual 2020 published March 2022, Table 4.8.A

Alternative C requires an additional 1,700 MW of battery storage and 3,000 MW of solar by 2026 on top of these planned additions. The figure below shows TVA's interconnection queue for solar and storage by year. The data shows a total of 822 MW of proposed storage projects and possibly another 1,168 MW of storage if 38%[26] of the solar/storage projects are battery storage capacity. Additionally, TVA's 2021 10-K includes nearly 250 MW of battery storage under Power Purchase Agreements (PPA) with power delivery expected to commence in either 2023 or 2025. Therefore, with only 1,740 MW of battery storage remaining in the queue, TVA would need every single storage project to be completed on schedule to support Alternative C; leaving no battery storage capacity available to complement the large amounts of planned solar additions. Moreover, the total solar capacity in TVA's interconnection queue is 10,400 MW with 6,561 of those megawatts having completed a system impact study. Per TVA's 2021 10-K, TVA has nearly 2,000 MW of solar PPAs and self-directed solar projects planned with power delivery expected to commence between 2022 and 2025. While there are more planned solar projects than storage, TVA's interconnection queue demonstrates that its planned levels of solar will need a significant portion of proposed solar projects to be completed; and even so, those levels could be insufficient to meet the needs of both the CUF retirement as well as keeping TVA on track to reach up to 10,000 MW of solar by 2035.

Figure 10: TVA's Interconnection Queue



Interestingly, there are still projects from 2020 in the queue that have not been completed which highlights the fact that not all projects get completed and not all projects get completed on schedule. The current TVA interconnection queue[27] shows, on average, it takes 3.25 years from the time a solar

[26] The interconnection queue only provides the total capacity for each project. It is assumed that the capacity reported is the capacity of the solar arrays with an unknown amount of storage. For estimation purposes, 38.5% was used based on NREL's 2021 Annual Technology Baseline solar plus storage project being characterized as 130MW of nameplate solar plus 50 MW of battery storage capacity.

[27] As of August 22, 2022

and/or storage project is listed in the queue until the time it is forecasted to be in-service. In addition, recent major solar projects that TVA has contracted with were completed, on average, 1.6 years behind the initial in-service provided when the project entered the interconnection queue. This indicates it is reasonable to expect (or at least plan for) solar and storage projects to take close to 5 years from the time a project joins the interconnection queue to the time it is commercially operational, on average. To further highlight the risk of taking the interconnection queue forecasted in-service dates at face value, as of August 22, 2022 there were 3,344 MW of solar projects having completed a system impact study and expected to be in-service before September 30, 2022 (and by 2021 yearend); only one project of 147 MW was listed as in the construction phase.

In addition to the complexity and scale of project development for Alternative C, the accompanying transmission and distribution upgrades have not been fully studied, primarily because the location of the new solar and storage projects are not fully known. In fact, those system impact studies are an important part of the interconnection process. Further, the Draft EIS indicates transmission upgrades could be needed at the CUF site to support system stability while additional transmission support for the Nashville area could be needed. In contrast, the Grid Strategies report assumes no transmission upgrades would be necessary because a combination of solar, battery storage, and other devices like a synchronous condenser can be installed in strategic locations to avoid costly system upgrades. To the contrary, because power plant retirements fundamentally change the flow of power on the transmission system, a holistic analysis of the transmission system is needed to confirm the necessary remedies. In the meantime, it is reasonable to expect transmission upgrades will be needed; especially for the retirement of CUF, one of the top ten largest coal plants in the U.S.

Summary

There is alignment about the retirement of CUF, which will result in additional capacity additions. Adding natural gas combined cycle generation to the exiting Cumberland site is an executable and reliable plan within the required timeframe, resulting in the accelerated retirement of a large coal unit. In contrast, adding significant near-term amounts of solar and storage beyond TVA's stated intention of up to 10,000 MW by 2035 would exhaust or go beyond TVA's current interconnection queue, requiring TVA to find resources outside its control area and heightening the risk of needing transmission upgrades to support system stability with the retirement of CUF.

Furthermore, as the Synapse report recommends, changing courses entirely and orchestrating a symphony of assumed capabilities and costs of energy efficiency, solar, wind, and batteries along with the accompanying transmission and distribution upgrades is simply not viable or based on a rigorous approach that meets system reliability requirements. TVA's thorough and broad long-term planning consistently identifies the need for natural gas generation, along with solar and storage, while the long-term amounts will be driven by future market conditions.

SUPPLEMENTAL OBSERVATION: THE INFLATION REDUCTION ACT INFLUENCES THE AMOUNT AND TIMING OF RESOURCES WITHIN THE RANGES CONTAINED IN THE IRP

TVA's 2019 IRP considered a wide range of strategies, scenarios, and sensitivities. As a result, TVA's long-term plans reflect ranges of future resource needs anticipating the need to adjust resources levels up or down depending on market conditions at the time of the decision. The comprehensive impacts of the IRA are uncertain and will take time to fully understand. Even so, because TVA's analyses explored a wide range of possible future outcomes, questions about the effects of the IRA can be qualitatively assessed by considering whether the potential impacts would trend resource amounts higher or lower within the 2019 IRP ranges. To that end, the figure below summarizes the potential IRA impacts to the level of future resources within the 2019 IRP ranges.

While the IRA impacts must be more fully modeled and explored, fundamental concepts and conclusions remain unchanged, such as the escalating complexity of adding renewable resources, the need for broad and rigorous analyses, and ultimately the need for dispatchable generation as part of a diverse and reliable generation portfolio. From a near-term perspective, the practicality of Alternative A over Alternative C is unchanged. While the IRA would improve the economics for Alternative C, the cost improvements would not eliminate its implementation barriers.

Figure 11: Potential Impacts Within 2019 IRP Resource Ranges

Resource Type	2019 IRP Range	Potential IRA Impact Within 2019 IRP Resource Ranges
Peak Demand	-0.7% to 1.7%	Uncertain net impact: load growth by electrification and focus on domestic manufacturing offset by load reductions from building codes and efficiency funding
Solar	Up to 14 GW	Uncertain net impact: improved wind economics reduce solar within the range, improved solar economics increase solar within the range, net load impacts are uncertain
Storage	Up to 5 GW	Trend up within the range if storage economics sustainably improve
Wind	Up to 4.2 GW if economic	Trend towards adding wind to the portfolio with the amount and timing uncertain, additional wind reduces solar, transmission uncertainties largely unchanged
DSM	Up to 2.1 GW if economic	Downward pressure: Federal funding for state administered programs and efficient building codes reduce utility sponsored opportunities
Combustion Turbine	Up to 8.6 GW	Downward pressure: trend lower within the range if more economic wind, trend lower within the range if battery storage is more economic, long-term gas prices are uncertain, net load impacts are uncertain, reliability needs unchanged or enhanced
Combined Cycle	Up to 9.8 GW	Downward pressure: trend lower within the range if more economic wind, trend lower within the range if battery storage is more economic, long-term gas prices are uncertain, net load impacts are uncertain, reliability needs unchanged or enhanced

WILLIAM (BILL) R. DAVIS
ASSISTANT VICE PRESIDENT

Mr. Davis is an energy industry professional with sixteen years of experience from a major Midwest electric and gas utility (Ameren). His career covers a variety of topics including load research, sales and revenue forecasting, integrated resource planning, project oversight, renewable energy standards, rate design, class cost of service studies, standby rates, demand-side resources pre-approval filings, demand-side resources market potential studies, implementation of energy efficiency portfolios, design of performance mechanisms for demand-side portfolios, lost revenue recovery, and prudence reviews.

PROFESSIONAL HISTORY

Concentric Energy Advisors, Inc. (2022 – Present)

Assistant Vice President

Ameren – St. Louis, MO (2005 –2021)

Director, Energy Solutions (2016 –2021)

Economic Analysis and Pricing Manager (2013 –2016)

Senior Corporate Planning Analyst (2011 – 2013)

Senior Load Research Specialist – Corporate Planning (2007 –2011)

Forecasting and Load Research Specialist–Corporate Planning (2005 - 2007)

Caterpillar Inc. – Peoria, IL (Feb. 2004 - May 2005)

Advanced Quantitative Analyst – Business Economics Group

EDUCATION

Illinois State University

Bachelor of Science in Economics (2002)
Masters of Science Degree in Economics (2003)

PROFESSIONAL EXPERIENCE

- Provided strategic direction for Ameren Missouri's energy efficiency and renewable energy programs. Responsible for the planning, implementation, and evaluation of Ameren Missouri's annual $50-$70 million energy efficiency portfolio
- Served as public spokesperson for energy efficiency on live or recorded television and radio.
- Responsible for meeting or exceeding Ameren Missouri's approved energy efficiency performance targets; resulting in annual $6-$13 million of additional revenue.

- Collaborated with regulators, interveners, including political and special interest groups, to obtain consensus, support, and/or regulatory approval
- Analyzed the economic and financial impacts of regulatory and legislative initiatives
- Developed and analyzed pricing options for Ameren Missouri's retail customers.
- Led cross-functional projects including workgroups such as budgeting, demand-side management, regulatory, legal, forecasting, power operations, transmission and distribution planning, treasury, environmental, renewables, and power trading
- Team leader to implement a custom application that automated and streamlined project oversight reporting and workflows
- Provided oversight for projects in excess of $10 million to ensure projects follow proper project management procedures and reduce risk associated with project execution
- Acted as a change agent to drive behavioral changes in project management practices
- Provided expert testimony to the Missouri Public Service Commission in Ameren Missouri's electric rate case regarding a proposal to mitigate the negative financial effects to the company caused by the implementation of energy efficiency programs
- Championed the analysis and adoption of a new residential rate design for Ameren Missouri's natural gas distribution business that significantly reduced the volatility of revenues and prevented a sustained annual revenue shortfall
- Provided quantitative analysis and recommended actions directly to Ameren executive leadership regarding long-term resource and regulatory decisions
- Team leader for Ameren Missouri's 2011 Integrated Resource Plan which provides the long-term direction for future demand-side and supply-side resource decisions
- Statistical modeling to forecast long-term electric and gas sales to support resource planning and budgeting. Other responsibilities include load research, sample design, weather normalization, margin impacts of weather, unbilled estimation, profiling, revenue/customer forecasting, regulatory support, and process optimization

Accomplishments

- Public Utilities Fortnightly Under 40 class of 2020. Public Utilities Fortnightly is the forum for stakeholders in utility regulation and policy and the Under 40 classes are a nomination-based recognition of rising stars in the public utility industry.
- 2019/2020 Leadership St. Louis Class. The Leadership St. Louis program is an immersive experience into the community to learn directly about regional challenges and opportunities.
- 2018 Zhi-Xing Eisenhower Fellow, one of nine Americans to spend 4 weeks in China for a cultural immersion and professional development experience. The Eisenhower Fellowship mission is to connect innovative leaders in a global network committed to creating a world more peaceful, prosperous and just.
- Leadership Missouri Class of 2014 graduate, which is a program hosted by the Missouri Chamber of Commerce designed to enhance leadership skills and deepen knowledge of the state's opportunities and challenges
- Project leader of an End-to-End Energy Efficiency Study which received Technology Transfer Award from the Electric Power Research Institute

SPONSOR	DATE	CASE/APPLICANT	DOCKET	SUBJECT
Illinois Commerce Commission				
Ameren Illinois Company	2012	Ameren Illinois	Docket No. 12-0244	Cost benefit analysis
Missouri Public Service Commission				
Union Electric Company	2010 2011	Ameren Missouri	Case No. ER-2011-0028	Alternative ratemaking approaches
Union Electric Company	2012	Ameren Missouri	Case No. ER-2012-0166	Revenue requirement and rate design
Union Electric Company	2012 2016	Ameren Missouri	File No. EO-2012-0142	Pre-approval, alternative ratemaking (energy efficiency)
Union Electric Company	2014 2015	Ameren Missouri	File No. ER-2014-0258	Rate design, pricing, cost of service
Union Electric Company	2014	Ameren Missouri	Case No. ER-2015-0132	Revenue requirement (energy efficiency)
Union Electric Company	2014	Ameren Missouri	File No. EC-2014-0224	Cost of service, pricing
Union Electric Company	2014	Ameren Missouri	Case No. EA-2014-0136	Renewable energy justification
Union Electric Company	2015 2016 2017 2018	Ameren Missouri	File No. EO-2015-0055	Pre-approval, alternative ratemaking (energy efficiency)
Union Electric Company	2015	Ameren Missouri	Case No. ER-2016-0131	Revenue requirement, incentive ratemaking (energy efficiency)
Union Electric Company	2015	Ameren Missouri	File No. ET-2016-0152	Pricing, Tariff design
Union Electric Company	2016 2017	Ameren Missouri	File No. ER-2016-0179	Rate design, cost of service study, tariff design
Union Electric Company	2016	Ameren Missouri	Case No. ER-2017-0149	Revenue requirement, incentive ratemaking (energy efficiency)

SPONSOR	DATE	CASE/APPLICANT	DOCKET	SUBJECT
Union Electric Company	2017	Ameren Missouri	File No. ER-2018-0144	Revenue requirement, incentive ratemaking, prudence review (energy efficiency)
Union Electric Company	2018	Ameren Missouri	Case No. ER-2019-0151	Revenue requirement, incentive ratemaking (energy efficiency)
Union Electric Company	2018 2020	Ameren Missouri	File No. EO-2018-0211	Pre-approval, alternative ratemaking (energy efficiency)
Union Electric Company	2019	Ameren Missouri	Case No. ER-2020-0147	Revenue requirement, incentive ratemaking (energy efficiency)
Union Electric Company	2020	Ameren Missouri	Case No. ER-2021-0158	Revenue requirement, incentive ratemaking (energy efficiency)