Document Type:	Final EIS–Administrative Record
Index Field:	Environmental Impact Statement
Project Name:	Shawnee CCR EIS
Project Number:	2016-13

Shawnee Fossil Plant Coal Combustion Residual Management
Final Environmental Impact Statement

Prepared by:
TENNESSEE VALLEY AUTHORITY
Knoxville, TN

December 2017

Ashley Pilakowski
NEPA Compliance
Tennessee Valley Authority
400 W. Summit Hill Drive
Knoxville, TN 37902
Phone: 865-632-2256
aapilakowski@tva.gov

COVER SHEET

Shawnee Fossil Plant
Coal Combustion Residual Management

Proposed action: As part of an effort to manage the disposal of Coal Combustion Residuals (CCR) materials on a dry basis, and to meet new CCR regulations, the Tennessee Valley Authority (TVA) is proposing to cease operations at the existing CCR Landfill (former Special Waste Landfill) and Ash Impoundment 2 in accordance with the CCR Rule and construct and operate a new CCR Landfill.

Type of document: Final Environmental Impact Statement (EIS)

Lead agency: Tennessee Valley Authority

Contact: Ashley Pilakowski
Tennessee Valley Authority
400 W Summit Hill Drive, WT 11DK
Knoxville, TN 37902
Phone: (865) 632-2256
Email: aapilakowski@tva.gov

Abstract:

The purpose of this EIS is to support TVA's goal to eliminate all wet storage at the Shawnee Fossil Plant (SHF), provide additional dry CCR material storage, and assist TVA in meeting new CCR regulations. TVA must decide whether and how to close the existing CCR landfill (former Special Waste Landfill - SWL) and Ash Impoundment 2, and whether to construct a new CCR Landfill or dispose of dry CCR at an offsite permitted landfill. TVA's decision will consider factors such as potential environmental impacts, economic issues, availability of resources and TVA's long-term goals. TVA developed three alternatives to be evaluated in this EIS: Alternative A – No Action Alternative, Alternative B - Construction and Operation of a new Onsite CCR Landfill and Closure-in-Place of the existing CCR Landfill (former SWL) and Ash Impoundment 2, and Alternative C - CCR Disposal at a Permitted Offsite Landfill and Closure of the Existing CCR Landfill and Ash Impoundment 2.

Alternative B is TVA's preferred alternative and provides advantages over Alternatives A and C. Alternative B would achieve the purpose and need of the project and avoid offsite transfer of CCR along public roads, thus eliminating the long-term impacts associated with air emissions, increased traffic and related safety risks, and disruptions to the public that would be associated with offsite transport.

Tennessee Valley Authority
Shawnee Fossil Plant Coal Combustion Residual Management
Final
Environmental Impact Statement
December 2017
Executive Summary

This Environmental Impact Statement (EIS) addresses the continued disposal of Coal Combustion Residuals (CCR) from the Tennessee Valley Authority's (TVA) Shawnee Fossil Plant (SHF). The plant is located in McCracken County, Kentucky, on the south bank of the Ohio River, about 13 miles northwest of Paducah.

SHF has nine active coal-fired generating units constructed between 1951 and 1957. A tenth unit was idled in 2010 and retired in 2014. Currently, SHF consumes an average of 2.7 million cubic yards of coal per year, which results in approximately 490,000 cubic yards of CCR annually. The coal ash is stored in both an onsite CCR landfill, which was formerly the Special Waste Landfill (SWL) and Ash Impoundment 2. The CCRs generated by the plant include fly ash and bottom ash and will include a flue gas desulfurization product after start-up of the dry scrubber in the fall of 2017.

The existing onsite CCR landfill, (former SWL), had a state landfill permit. However, it is now a CCR Landfill under a Registered Permit-by-Rule with the Kentucky Division of Waste Management (KDWM) effective September 21, 2017, as well as under the EPA CCR rule. Although Ash Impoundment 2 still maintains an operating permit in accordance with the Kentucky Division of Water, Kentucky Pollutant Discharge Elimination System (KPDES) Permit No. KY0004219, it also was transitioned to a Registered Permit-by-Rule under Kentucky's CCR Rule on September 21, 2017. In the Draft EIS released on June 8, 2017, the onsite landfill was called the SWL. For consistency with the Draft EIS, the onsite existing CCR landfill is referred to in the Final EIS as the former SWL.

The estimated remaining capacity for the former SWL is approximately 5.2 million cubic yards. Due to current and projected SHF operations, it is expected that the former SWL will reach capacity by 2027. To accommodate the need for additional dry CCR storage at SHF, TVA is proposing to design, build and operate a new CCR Landfill that would accommodate up to 20 additional years of storage capacity. SHF is expected to produce approximately 490,000 to 910,000 cubic yards of CCR per year until year 2040. Approximately 10 to 20 million cubic yards of disposal capacity is desired for the 20-year comprehensive disposal plan.

Historically, TVA managed its CCR in wet impoundments or dry landfills. Since 2009, TVA began converting its wet CCR management practices to dry storage. The U.S. Environmental Protection Agency (EPA) published its final Disposal of Coal Combustion Residuals from Electric Utilities rule (CCR Rule) in 2015. Under the CCR Rule, impoundments are potentially subject to a closure deadline of five years, with the possibility of an extension of the closure time period under certain circumstances.

TVA must decide whether and how to close the former SWL and Ash Impoundment 2, and whether to construct a new CCR Landfill or dispose of dry CCR at an offsite permitted landfill. TVA's decision will consider factors such as potential environmental impacts, economic issues, availability of resources and TVA's long-term goals.

Programmatic EIS

In June of 2016, TVA issued the Final PEIS that analyzed methods for closing CCR impoundments at TVA fossil plants system-wide. The PEIS identified specific screening and evaluation factors to help frame its assessment of closures at all TVA facilities with impoundments. A Record of Decision was released in July 2016 that allowed future environmental reviews of CCR impoundment closures to apply findings in the PEIS.

The PEIS addressed the environmental effects of two primary ash impoundment closure methods:

- *Closure-in-Place* involves stabilizing and contouring the CCR in place and installing a cover system that virtually eliminates rainfall from entering the impoundment. This can also include consolidation within the existing unit.
- *Closure-by-Removal* involves excavating and relocating the CCR from the ash impoundment in accordance with federal and state requirements to an approved onsite or offsite disposal facility. Under this method, the CCR may also be beneficially used in products or structural fills.

The evaluation of the closure alternatives for the SHF Ash Impoundment 2 and the former SWL in this EIS draw from the 2016 PEIS. The former SWL at the site differs from the Ash Impoundments evaluated in the PEIS in that the material stored in this landfill is dry CCR rather than wet material. The former SWL is adjacent to Ash Impoundment 2 and is sited on top of the former Ash Impoundment 1.

Given the location of the former SWL with respect to Ash Impoundment 2 and former Ash Impoundment 1, the similarities in stored materials and proposed closure activities/methods, as well as the State of Kentucky's new Registered-Permit-by-rule decision, TVA has deemed it appropriate to also tier closure of the former SWL from the PEIS.

Alternatives Considered

During initial project planning, TVA considered a range of alternatives and specific screening criteria with respect to the proposed actions.

Preliminary Alternatives Analysis

In 2015, TVA performed a siting study to evaluate onsite and offsite alternatives for the construction of a landfill for storage of dry CCR from SHF. The siting study identified six alternative sites (Options 1 through 6), within 5 to 10 miles of the plant, for the construction and operation of a new CCR Landfill. The siting study also considered the offsite transport of CCR to one of three existing, permitted, third-party landfills as a potential alternative. The impact of development and/or use of each of the landfill alternatives were further evaluated against environmental and engineering factors to determine those sites that should be carried over for further analysis in the study. Ultimately, one site for construction and operation of a new CCR Landfill (Option 1) and one existing, permitted, third-party landfill (Freedom Waste Landfill) were identified as potential alternatives to be carried forward for further evaluation.

Also in 2015, TVA completed the *Special Waste Landfill and Ash Impoundment 2 Final Closure Projects - Project Planning Document* (PPD). This PPD evaluated four alternatives (each with varying numbers of sub-alternatives) as methods of closure of the former SWL and Ash Impoundment 2. The four alternatives and their respective sub-alternatives are listed below:

1. Alternative 1 considered Closure-by-Removal of all CCR (wet and dry) from both facilities. Removal by truck, barge, and rail were considered, as were new onsite and offsite landfills for receiving the removed material.

2. Alternative 2 considered Closure-in-Place for Ash Impoundment 2 by reducing its footprint by consolidating material within the former SWL, and Closure-in-Place for the former SWL.

3. Alternative 3 considered Closure-by-Removal of the former SWL and Closure-in-Place of Ash Impoundment 2. Removal by truck and barge were considered as was new onsite and offsite landfills for receiving the removed material.

4. Alternative 4 considered Closure-in-Place of the former SWL and Ash Impoundment 2 via redistribution of CCR within the existing locations or general grading of the existing locations.

In guidance on the CCR Rule, the EPA has stated that dewatering and leaving CCRs in place offers potential environmental benefits through the elimination of “significant truck traffic that would accompany offsite disposal of CCRs” (EPA 2017). EPA also suggests that onsite CCR consolidation can “provide for greater land use options and flexibility”. In-place waste consolidation can also allow a long-term focus on monitoring, care, and cleanup in a single location rather than multiple locations (EPA 2017).

Ultimately, based on these observations, and feasibility as indicated by environmental, engineering, and cost factors, TVA selected Alternative 2, Closure-in-Place with a reduced footprint for Ash Impoundment 2 (consolidating material) and Closure-in-Place for the former SWL, to carry forward for further evaluation.

Alternatives Evaluated in the EIS

TVA used results of the preliminary alternatives analysis to identify two feasible action alternatives, in addition to a No-Action alternative (Alternative A) which served as a baseline.

Under Alternative B, TVA would close Ash Impoundment 2 in-place by reducing its footprint, close the former SWL in-place and build and operate a new CCR Landfill on a portion of the original Option 1 site known as the Shawnee East Site. The Shawnee East Site consists of about 205 acres that TVA acquired in 2016 next to the eastern boundary of SHF. This site would also be used for borrow material for both construction of the new CCR Landfill and for the closures of Ash Impoundment 2 and the former SWL.

Under Alternative C, TVA would close Ash Impoundment 2 in-place by reducing its footprint and close the former SWL in-place. Dry CCR produced by daily operations at SHF would be transported to the Freedom Waste Landfill, in Mayfield, Kentucky (approximately 32 miles from SHF) on public roadways. No landfill would be constructed on the Shawnee East Site, but borrow materials from that site would be used in the closure process.

Public and Agency Involvement

On November 1, 2016, TVA published a Notice of Intent (NOI) in the Federal Register announcing the plan to prepare an EIS to address the potential environmental effects associated with ceasing operations at the former SWL and Ash Impoundment 2 and constructing, operating, and maintaining a new CCR Landfill at SHF. The 30-day public scoping period concluded on December 1, 2016. TVA also sent the NOI to local and state government entities and federal agencies, published notices regarding this effort in local newspapers; issued a press release to media; posted the news release on the TVA website; and notified residents within a three mile radius of the plant.

TVA hosted an open house scoping meeting on November 15, 2016, at the Robert Cherry Civic Center in Paducah, Kentucky. Comments were received in relation to the project purpose and need, alternatives, impact analysis, cumulative impacts, groundwater and surface water, aquatic ecology and threatened and endangered species, general environmental concerns, transportation, the NEPA Process and Scoping Meeting, and other general topics.

In association with the publication of the Draft EIS, TVA hosted a public meeting on June 22, 2017, at the Robert Cherry Civic Center in Paducah, Kentucky. Notification of the public meeting was sent to local residents adjacent to the SHF plant, and also published in local newspapers. Local and regional stakeholders, governments, and other interested parties were also informed of the publication of the Draft EIS and provided information about the public meeting.

TVA received a total of 83 comments from eight commenters in relation to the Draft EIS which are summarized in Appendix I.

Summary of Alternative Impacts

The EIS presents a summary of the impacts of each of the alternatives carried forward for detailed analysis. The environmental impacts of Alternatives A, B and C are summarized in Table 2.3-1 in Chapter 2.

Under Alternative B, there would be minor to moderate impacts to surface water, visual resources, and noise. Potential impacts associated with the discharge of storm water from the new landfill would be mitigated as needed to ensure compliance with the Clean Water Act. There would be moderate impacts to visual resources associated with changes in viewshed around the new landfill. Additionally, there would be minor to moderate noise impacts in the vicinity of the new landfill as a result of construction and operational noise. The visual resources and noise impacts would be partially mitigated by the construction and maintenance of a vegetative barrier around the boundaries of the new landfill. Also under Alternative B there would be minor impacts to air quality; land use; prime farmland; geology; groundwater; vegetation; wildlife; aquatic ecology; threatened and endangered species; wetlands; natural areas, parks, and recreation; transportation; cultural resources; solid waste and hazardous materials; and public health and safety. There would be no impacts to climate change and greenhouse gases, floodplains, and environmental justice. There would also be negligible beneficial impacts to socioeconomics.

Under Alternative C, impacts to air quality, transportation, solid waste and hazardous waste and hazardous materials, and public health and safety would be higher than under Alternative B because of the transportation of CCR materials from SHF to an offsite landfill. Also under Alternative C there would be minor impacts similar to those for Alternative B to land use; prime farmland; geology; groundwater; surface water; vegetation; wildlife; aquatic ecology; threatened and endangered species; wetlands; natural areas, parks, and recreation; visual resources; cultural resources; noise; and solid waste and hazardous materials. There would be no impacts to climate change and greenhouse gases, floodplains, and environmental justice. There would also be negligible beneficial impacts to socioeconomics.

Preferred Alternative

Alternative B – Construction of an Onsite CCR Landfill, Closure-in-Place of Ash Impoundment 2 with a reduced footprint, and Closure-in-Place of the former SWL is TVA's preferred alternative. This option would achieve the purpose and need of the project and avoid offsite transfer of CCR along public roads, thus eliminating the long-term impacts associated with air emissions, increased traffic and related safety risks, and disruptions to the public that would be associated with offsite transport.

Mitigation Measures

Mitigation measures designed to minimize or reduce adverse impacts associated with implementation of Alternative B include:

- Due to the loss of potentially suitable foraging and roosting habitat for endangered bat species, Section 7 consultation with the United States Fish and Wildlife Service (USFWS) would be required. Any tree removal would be scheduled so that all tree clearing would be conducted between October 15 and March 31.
- Actions involving wetlands and/or stream crossings and stream alterations would be subject to requirements outlined in the federal Clean Water Act Section 404 permit. TVA

would adhere to all conditions stipulated in this permit. An approved jurisdictional determination by the USACE determined that only a 0.7-acre wetland on the Shawnee East Site would require a Section 404 permit for impacts that could occur in conjunction with clearing, excavating, or grading during landfill construction. Where impacts to wetlands cannot be avoided, the Section 404 permitting program would require mitigation to offset impacts, and these mitigation measures would be clarified at the end of consultation with the USACE.

- To minimize visual and noise impacts, TVA would plant and maintain a vegetative buffer around the proposed CCR Landfill as a natural screen.
- TVA would avoid the National Register of Historic Places (NRHP)-eligible sites in the vicinity of the Shawnee East Site.

Best Management Practices (BMPs) include:

- TVA would continue regulatory groundwater and surface water testing in compliance with existing regulations and permits. TVA also would implement measures such as water quality monitoring, assessment, and corrective action programs as mandated by state requirements and the CCR rule.
- Any discharges during construction and operation activities would comply with KPDES limits and Kentucky Water Quality Standards to ensure in-stream water quality. The leachate would be treated as required to meet all applicable KPDES permit requirements and in-stream water quality standards. TVA would characterize the leachate and runoff streams to confirm no significant impacts to the Ohio River or the Unnamed Tributary to Little Bayou Creek. The discharge waters would be analyzed for metals and other parameters. If determined to be necessary, appropriate mitigation measures, which could include the rerouting of this waste stream to either the proposed Process Water Basin(s) or directly to the Ohio River, would be evaluated and implemented to ensure that the discharge limits in the KPDES permit are met.
- Other Best Management Practices would be applied at the site including dust suppression, equipment cleaning, solid waste disposal and management, appropriate project permitting, use of native and non-invasive ground cover, construction, and storm water handling.

Table of Contents

List of Appendices

List of Tables

List of Figures

Symbols, Acronyms, and Abbreviations

°F	degrees Fahrenheit
AADT	annual average daily traffic
APE	area of potential effect
BMP	Best management practice
CCR	coal combustion residuals
CCW	condenser cooling water
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH_4	methane
CO_2	carbon dioxide
dB	decibels
dBA	A-weighted decibel
DOE	U.S. Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FGD	Flue-gas desulfurization
GHG	greenhouse gases
GIS	Global Information System
HFCs	hydroflurocarbons
HPA	Habitat Protection Area
HUD	U.S. Department of Housing and Urban Development
Hz	Hertz
I	Interstate
IPaC	Information for Planning and Conservation
IWBmod	modified Index of Well-Being
KAR	Kentucky Administrative Regulations
KDEP	Kentucky Department of Environmental Protection
KDFWR	Kentucky Department of Fish and Wildlife Resources
km	kilometers
KPDES	Kentucky Pollutant Discharge Elimination System
KRS	Kentucky Revised Statutes
KSNPC	Kentucky State Nature Preserve Commission
LCD	Lower Continental Deposits
LCS	leachate collection system
Ldn	day-night sound level
LOS	Level of Service
MBTU/Hr	million British Thermal Units per hour
MCLs	maximum contaminant levels
MGD	millions of gallons per day
mg	milligrams
MOA	Memorandum of Agreement
mORFIn	modified Ohio River Fish Index

Symbols, Acronyms, and Abbreviations (continued)

MVM	million vehicle miles
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum
NEPA	National Environmental Policy Act
NH_3-N/kg	nitrate-nitrogen per kilogram
NHPA	National Historic Preservation Act
NOI	Notice of Intent
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
ORM	Ohio River Mile
OSHA	Occupational Safety and Health Administration
PCBs	polychlorinated biphenyls
PEIS	Programmatic Environmental Impact Statement
PEM	Palustrine emergent
PFCs	perflurocarbons
PFO	Palustrine forested
PGDP	Paducah Gaseous Diffusion Plant
PPD	Project Planning Document
PSS	Palustrine shrub scrub
PUB	Palustrine unconsolidated bottom
RCRA	Resource Conservation and Recovery Act
RGA	Regional Gravel Aquifer
RIF	Relative Impact Framework
SF_6	sulfur hexafluoride
SH	State Highway
SHF	Shawnee Fossil Plant
SHPO	State Historic Preservation Officer
SWL	Special Waste Landfill
SWPPP	Storm Water Pollution Prevention Plan
TCE	trichloroethylene
TMDL	total maximum daily loading limit
TVA RAM	TVA Rapid Assessment Method
TVA	Tennessee Valley Authority
UCD	Upper Continental Deposits
USACE	United States Army Corps of Engineers
USC	United States Code
USCB	United States Census Bureau
USFWS	United States Fish and Wildlife Service
USGS	U.S. Geological Survey
WKWMA	Western Kentucky Wildlife Management Area
WOTUS	waters of the United States
yd^3	cubic yards

This page intentionally left blank

CHAPTER 1 - PURPOSE AND NEED FOR ACTION

1.1 Introduction and Background

Tennessee Valley Authority's (TVA) Shawnee Fossil Plant (SHF) is located in McCracken County, Kentucky. The plant is located on the south bank of the Ohio River, about 13 miles northwest of Paducah, Kentucky (Figure 1.1-1). SHF has 10 coal-fired generating units constructed between 1951 and 1957. Nine of those units are currently active generating units with a summer net generating capacity of 1,206 megawatts. The plant's Unit 10 was idled in 2010 and retired in 2014. Currently, SHF consumes an average of 2.7 million cubic yards of coal per year, generates approximately 8 billion kilowatt-hours of electricity a year (enough to supply 540,000 homes). Until October 2017, SHF produced approximately 183,000 cubic yards of coal combustion residuals (CCR) a year. In October 2017, newly installed selective catalytic reduction (SCR) and flue gas desulfurization (FGD) systems became operational on SHF Units 1 and 4 increasing the amount of CCR to an estimated 490,000 cubic yards per year. All CCR are managed in both the existing onsite landfill and Ash Impoundment 2. The CCRs generated by the plant include fly ash and bottom ash and dry scrubber product.

The existing onsite landfill, formerly the Special Waste Landfill (SWL), had a state landfill permit. However, it is now considered a CCR Landfill under a Registered Permit–by-Rule with the Kentucky Division of Waste Management (KDWM) effective September 21, 2017. Although Ash Impoundment 2 still maintains an operating permit in accordance with the Kentucky Division of Water Kentucky Pollutant Discharge Elimination System (KPDES) Permit No. KY0004219, it also was transitioned to a Registered Permit-by-Rule under Kentucky's CCR Rule on September 21, 2017. In the Draft EIS released on June 8, 2017, the onsite landfill was called the SWL. For consistency with the Draft EIS the onsite landfill is referred to in the Final EIS as the former SWL.

The estimated remaining capacity for the former SWL is approximately 5.2 million cubic yards. Due to current and projected SHF operations, it is expected that the former SWL will reach capacity by 2027. To accommodate the need for additional dry CCR storage at SHF, TVA is proposing to design, construct, and operate a new CCR Landfill that would accommodate up to 20 additional years of storage capacity. SHF is expected to produce approximately 490,000 to 910,000 cubic yards of CCRs (bottom ash, fly ash, and dry scrubber product) per year until 2040. The low-end of this range in CCR production is based on the current plant configuration, including the use of SCR and FGD systems on SHF Units 1 and 4 which became operational in October 2017. The higher-end of this range provides the maximum CCR output that could be anticipated should TVA elect to explore the option of installing similar SCR and FGD systems on the other SHF units in the future. At present, TVA has no plans to install such systems. Approximately 10 to 20 million cubic yards of disposal capacity is desired for the 20-year SHF comprehensive disposal plan.

G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Final Figures\Figure_1.1-1_LocationMap.mxd

Figure 1.1-1. SHF Location Map

Historically, TVA has managed its CCR in wet impoundments or dry landfills. In July 2009, the TVA Board of Directors passed a resolution for staff to review TVA practices for storing CCR at its generating facilities (including SHF), which resulted in a recommendation to convert the wet ash management system at SHF to a dry storage system. On April 17, 2015, the U.S. Environmental Protection Agency (EPA) published the final Disposal of Coal Combustion Residuals from Electric Utilities rule (CCR Rule) in the Federal Register. Under the CCR Rule, impoundments are potentially subject to a closure deadline of five years, with the possibility of an extension of the closure time period under certain circumstances.

In June of 2016, TVA issued a Final Programmatic Environmental Impact Statement (PEIS) that analyzed methods for closing impoundments that hold CCR materials at TVA fossil plants and identified specific screening and evaluation factors to help frame its assessment of closures at additional facilities. A Record of Decision was released in July 2016 that would allow future environmental reviews of CCR impoundment closures to tier from the PEIS.

TVA is initiating the preparation of an Environmental Impact Statement (EIS) pursuant to the National Environmental Policy Act (NEPA) to assess the environmental impacts of the proposed actions. A portion of this EIS is intended to tier from the 2016 PEIS to evaluate the closure alternatives for the Ash Impoundment 2 and analyze the impacts of the closure of the former SWL. This EIS also evaluates the construction and operation of a new onsite CCR Landfill to accommodate future dry CCR disposal actions or the disposal of dry CCR at an offsite, permitted, third-party landfill. The decision supports TVA’s goal to eliminate all wet ash storage at its coal plants and comply with the federal CCR Rule.

1.1.1 Current Management of CCR Material at SHF

The active coal-fired generating units at SHF produce CCRs, primarily fly ash and bottom ash during power generation. The fly ash is treated in a dry process and is disposed in the former SWL onsite. The bottom ash is currently managed onsite in the impoundment and a landfill. Under this process, the bottom ash that collects in the bottom of the boiler inside the powerhouse is washed from the boiler bottoms and sluiced to the bottom ash impoundment. The bottom ash settles out of the sluice water in the impoundment. After settling, the bottom ash is dug up and allowed to dry in piles within the footprint of the impoundment. After further dewatering and drying, the bottom ash is transported to the former SWL.

In October 2017, the newly installed SCR and FGD systems became operational on SHF Units 1 and 4. SCR systems reduce nitrogen oxide (NO_x) emissions and FGD systems reduce sulfur dioxide (SO_2) emissions. FGD systems are commonly referred to as “scrubber systems”. SCR systems do not produce CCR wastes.

The scrubber system TVA installed is a Spray Dryer Absorber or “SDA”. When TVA burns coal, CCR is created during the process. SHF will produce bottom ash, fly ash and scrubber waste. Bottom ash is collected as a separate waste stream, but, when SDA scrubbers are present, fly ash and scrubber waste are collected and conveyed together as a single waste stream. In the *Shawnee Fossil Plant Units 1 and 4 EA* (TVA 2014), TVA evaluated the disposal of fly ash and scrubber waste from all units at SHF (Units 1 through 9) in the former SWL. TVA applied for and received a modification to the permit from the State of Kentucky to allow the disposal of SDA scrubber by-products in the former SWL in the fall of 2017. The commencement of operations on the scrubbers increased CCR output at SHF to an estimated 490,000 cubic yards per year.

In September 2016, TVA completed the *Shawnee Fossil Plant Bottom Ash Process Dewatering Facility Final Environmental Assessment*. This bottom ash dewatering facility will process the bottom ash sluice flows to allow for dry handling of this CCR. Dewatering activities could include decanting or drawdown (which is the removal of free or ponded liquid from an impoundment and must meet current permit limits) up to the removal of water in the pore spaces of the impoundment. These activities could require additional monitoring or meeting additional limits from state regulators. Once built, the CCR from the new dewatering facility will be disposed of in the existing former SWL. Water that would discharge from the dewatering process would be discharged according to TVA’s current permit requirements or would be recirculated back into the intake at the powerhouse where it could be reused. Until the dewatering facility is completed, the bottom ash would continue to be wet-sluiced to the Ash Impoundment 2 (Figure 1.1-2). Ash Impoundment 2 would continue to be operated under the current KPDES permit. Following completion of the dewatering facility, dry ash would be stored in the former SWL. Construction of the SHF Bottom Ash Process Dewatering Facility began in April 2017. The facility is expected to become operational in December 2018.

The former SWL (Figure 1.1-2) is expected to reach capacity by 2027. TVA has identified the need for additional long-term storage of dry CCR materials produced at SHF, as well as closing the existing wet storage impoundment.

1.2 Purpose and Need

As part of an effort to manage the disposal of CCR materials on a dry basis, and to meet new CCR regulations, TVA is proposing to cease CCR management operations at the former SWL and Ash Impoundment 2 in accordance with the CCR Rule. A new CCR Landfill would be constructed in compliance with all of the CCR Rule requirements and performance standards, then TVA would operate the new CCR Landfill.

The purpose of this EIS is to support TVA’s goal to eliminate all wet storage at the SHF, provide additional dry CCR material storage, and assist TVA in meeting new CCR regulations.

1.3 Decision to be Made

TVA must decide whether and how to close the former SWL and Ash Impoundment 2, and whether to construct a new CCR Landfill or dispose of dry CCR at an offsite permitted landfill. TVA’s decision will consider factors such as potential environmental impacts, economic issues, availability of resources and TVA’s long-term goals.

Figure 1.1-2. TVA Shawnee Fossil Plant

1.4 Related Environmental Reviews

TVA previously conducted the following environmental reviews, which are relevant to this EIS concerning ash management:

- TVA 2016, Ash Impoundment Closure Part I Programmatic NEPA Review, Final Environmental Impact Statement
- TVA 2016, Shawnee Fossil Plant Bottom Ash Process Dewatering Facility Final Environmental Assessment
- TVA 2016, Bull Run Fossil Plant Landfill Final Environmental Impact Statement
- TVA 2015, TVA's Integrated Resource Plan
- TVA 2014, Shawnee Fossil Plant Units 1 and 4 Final Environmental Assessment

1.5 Scope of the Analyses

TVA has identified the following resources as having the potential to be affected by the proposed action:

- Air Quality
- Climate Change and Greenhouse Gases
- Land Use
- Prime Farmland
- Geology and Seismology
- Groundwater
- Surface Water
- Floodplains
- Vegetation
- Wildlife
- Aquatic Ecology
- Threatened and Endangered Species
- Wetlands
- Socioeconomics and Environmental Justice
- Natural Areas, Parks and Recreation
- Transportation
- Visual Resources
- Cultural and Historical Resources
- Noise
- Solid and Hazardous Waste and Hazardous Materials
- Public Health and Safety

TVA's action would satisfy the requirements of Executive Order (EO) 11988 (Floodplain Management), EO 11990 (Protection of Wetlands), EO 12898 (Environmental Justice), EO

13751 (Invasive Species); applicable laws including the National Historic Preservation Act, Endangered Species Act, Clean Water Act, and Clean Air Act.

1.6 Public and Agency Involvement

On November 1, 2016, TVA published a Notice of Intent (NOI) in the Federal Register announcing that it planned to prepare an EIS to address the potential environmental effects associated with ceasing operations at both the former SWL and Ash Impoundment 2, and constructing, operating, and maintaining a new CCR Landfill at SHF. The NOI initiated a 30-day public scoping period, which concluded on December 1, 2016. In addition to the NOI in the Federal Register, TVA sent notification of the NOI to local and state government entities and federal agencies, published notices regarding this effort in local newspapers; issued a press release to media; and posted the news release on the TVA Website (see Appendix A).

TVA hosted an open house scoping meeting on November 15, 2016, at the Robert Cherry Civic Center located at 2701 Park Avenue in Paducah, Kentucky. Notification of the open house was sent to local residents within a 1-mile radius of the SHF plant, and also published in local newspapers. Local and regional stakeholders, governments, and other interested parties were informed of the publication of the NOI and provided information about the scoping meeting. The purpose of the scoping period and open house meeting was to present TVA's project objectives and initial alternatives and encourage input from the public and interested stakeholders.

TVA received a wide variety of comments regarding the future management of CCR at SHF. TVA received a total of 51 comments from seven commenters. Of the seven submissions, one was from a federal entity, one was from a state entity, one was from a group of environmental organizations, and four were from members of the public.

Comments received related to the project purpose and need, alternatives, impact analysis, cumulative impacts, groundwater and surface water, aquatic ecology and threatened and endangered species, general environmental concerns, transportation, the NEPA Process and Scoping Meeting, and other general topics. Comment submissions are included in Appendix A.

In addition to comments on the proposed action, TVA received a copy of four comment submissions which had been submitted previously in relation to the *Final Ash Impoundment Closure Environmental Impact Statement* (PEIS) process. Those four sets of comments have been addressed previously in Appendix A of the PEIS and are not addressed further in this EIS. The PEIS is available on the TVA website at: https://www.tva.gov/Environment/ Environmental-Stewardship/Environmental-Reviews/Closure-of-Coal-Combustion-Residual-Impoundments.

TVA also received one request from an individual wishing to be added to the mailing list for future information about the project, and four out-of-scope comments that are not related to the proposed actions. TVA addressed those comments on an individual basis.

TVA released the Draft EIS on June 8, 2017, and the notice of availability was published in the Federal Register on June 18, 2017, initiating a 45-day public scoping period which concluded on July 31, 2017. In addition to the notice in the Federal Register, TVA sent notification of the availability of the Draft EIS to local and state government entities and federal agencies, published notices regarding this effort in local newspapers; issued a press release to media; and posted the news release on the TVA Website (Appendix I).

TVA hosted a public meeting on June 22, 2017, at the Robert Cherry Civic Center in Paducah, Kentucky. Notification of the public meeting was sent to local residents within a 1-mile radius of the SHF plant, and also published in local newspapers. Local and regional stakeholders, governments, and other interested parties were also informed of the publication of the Draft EIS and provided information about the scoping meeting.

TVA accepted comments submitted through mail, email, a comment form on the public website, and at the public meeting. TVA received a wide variety of comments regarding the future management of CCR at SHF. TVA received a total of 83 comments from eight commenters. Of the eight submissions, three were from federal entities, one was from a state entity, one was from a group of environmental organizations, and three were from members of the public.

Comments were received in relation to the Draft EIS sufficiency and timing, ash contact with groundwater and leaching of CCR parameters, groundwater and surface water impact, CCR Rule compliance, landfill site selection, closure-by-removal alternatives analysis, other disposal areas, beneficial reuse of CCR, and other general topics.

TVA carefully reviewed all of the substantive comments that were received. Summarized comments, TVA’s responses, and the original comment submissions are included in Appendix I.

1.7 Necessary Permits and Licenses

Depending on the decisions made regarding the proposed actions, TVA may need to obtain or seek amendments to the following permits:

- A request to modify the Title V air quality operating permit (Title V) would be submitted prior to beginning construction.
- TVA would evaluate the proposed actions to determine if a modification to the KPDES permit or notification to Kentucky Department of Environmental Protection (KDEP) would be required due to potential alteration of the wastewater stream(s).
- The project would disturb greater than one acre of land. By rule, any construction project that disturbs greater than one acre of land requires a KPDES General Storm Water Construction Permit, which would include incorporating details of the project in the SHF Best Management Practice (BMP) plan or developing a project-specific BMP plan.
- A 401/404 permit could be required for stream/wetlands mitigation depending on the alternative selected.
- Due to changes in Kentucky legislation, TVA has obtained a Registered Permit-by-Rule from the Kentucky Division of Waste Management for the former SWL and Ash Impoundment 2.

CHAPTER 2 - ALTERNATIVES

2.1 Preliminary Alternatives

During initial project planning, a range of alternatives and specific screening criteria were identified for each of the proposed projects individually (1) closure of the existing former SWL and Ash Impoundment 2, and (2) construction and operation of a new onsite CCR Landfill, or offsite CCR disposal. The various alternatives for each of the proposed projects are described in more detail below.

2.1.1 Long-Term Storage

TVA has considered numerous options for long-term storage of dry CCR produced at SHF. These options are explained below and include onsite disposal in the former SWL, construction of a new landfill, and existing offsite permitted landfill disposal options.

In 2015, TVA conducted the New Landfill Siting Study to evaluate potential locations for the disposal of dry CCR that will be produced at SHF after completion and commencement of operations of the new dewatering facility (Stantec 2016c). The study included locations for a proposed new CCR Landfill in McCracken County, Kentucky, and offsite existing landfill locations in Western Kentucky. Evaluated sites included TVA property, for-sale properties, not-for-sale properties, and offsite privately-owned landfills. Additionally, TVA considered disposal of dry CCR into the former SWL. A modification of the existing permit would have been required (prior to transition to a KDWM Registered Permit by Rule) in order to take the new waste stream to the former SWL for either the short term while a new facility is being developed, or as a long-term disposal option. New information regarding the seismic conditions of the area and stability requirements since the original permitting prompted TVA to impose a capacity limit to be disposed of in the former SWL. TVA estimates approximately 8 million cubic yards of dry CCR will be produced at SHF between 2020 and 2044. There is not sufficient capacity to dispose of the dry CCR in the former SWL and this option was not carried forward for detailed analysis.

The following sections describe the results of the siting study evaluation of construction of a new CCR Landfill in the vicinity of SHF and disposal of dry CCR at an existing offsite permitted landfill. The New Landfill Siting Study is included in Appendix G.

2.1.1.1 Construction and Operation of a New CCR Landfill

Based on the waste generation assumptions (approximately 8 million cubic yards), TVA estimated a need for a landfill with a minimum 140-acre footprint for the waste disposal area. A viable site would have to be large enough to accommodate the 140-acre landfill, a buffer area, storm water basin, leachate pond, roadways, and other ancillary facilities such as office buildings.

Candidate sites for the location of a new CCR Landfill were visually identified based on a desktop review of parcel data in a 5- to 10-mile vicinity of SHF with the focus on sites adjacent or nearly adjacent to the facility. Initial site screening included analysis of aerial imagery, U.S.

Geological Survey (USGS) topographic contours, wetlands, floodplains, streams, jurisdictional waters, and public road access. Initially, six sites (Options 1 through 6) within five miles of SHF were identified and evaluated for the location of a new CCR Landfill (Figures 2.1-1 through 2.1-4). The “Proposed Site Boundary” lines shown in red on the Figures 2.1-1 through 2.1-4 indicate the total area of each Option Site, which would be acquired for each 140-acre landfill footprint (shown by the blue dashed line) plus ancillary features.

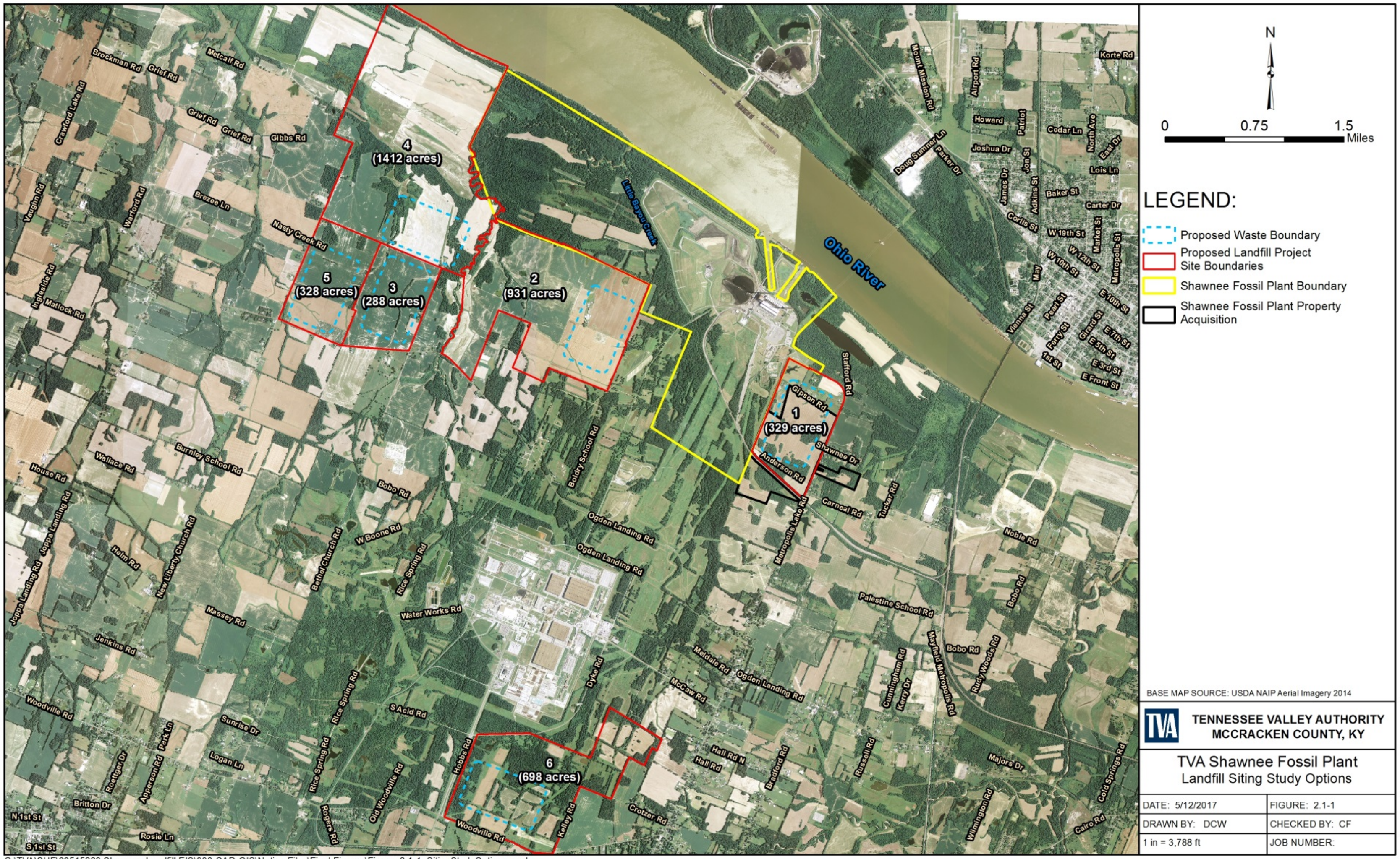
Preliminary site screening of the locations for a new CCR Landfill resulted in the elimination of Options 4, 5, and 6. Approximately 60 percent of Option 4 was located within a floodplain; wetlands were also present on the Option 4 site, and along the probable access route between this site and SHF. Options 5 and 6 were eliminated because of the distance from the SHF point of generation (approximately 7.5 and 5.5 miles, respectively, via public roadways).

Options 1, 2, and 3 were selected for a more in-depth analysis and were rated and scored based on the following evaluation criteria (Stantec 2016c):

- Site availability (available for purchase by TVA)
- Site location considerations (including proximity to public lands and sensitive resources)
- Geotechnical and subsurface conditions
- Regulatory considerations
- Design and construction (with minimum required acreage for a 20-year design life)
- Potential public opposition
- Economics (cost)

2.1.1.1.1 Option 1

The Option 1 site includes approximately 330 acres located east and adjacent to the existing SHF property. There are small areas of wetlands on the site and an intermittent stream. The site is partially within the documented plume of contamination of the Paducah Gaseous Diffusion Plant (PGDP). There are private wells on the property and adjacent properties. Because of the contamination plume, drinking water wells have been capped and locked. Other wells in the area are monitoring wells. The site is not within the 100-year floodplain and does not drain to Metropolis Lake. The McCracken County Future Land Use Plan shows the entirety of the site as Heavy Industrial, though the site had been used for agriculture for a number of years prior to completion of the siting study. The site is approximately 5 miles northwest of an existing school, directly adjacent to a natural area (to the southwest), and has neighboring residential properties immediately to the east.



G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Final Figures\Figure_2.1-1_SitingStudyOptions.mxd

Figure 2.1-1. Landfill Siting Study Options

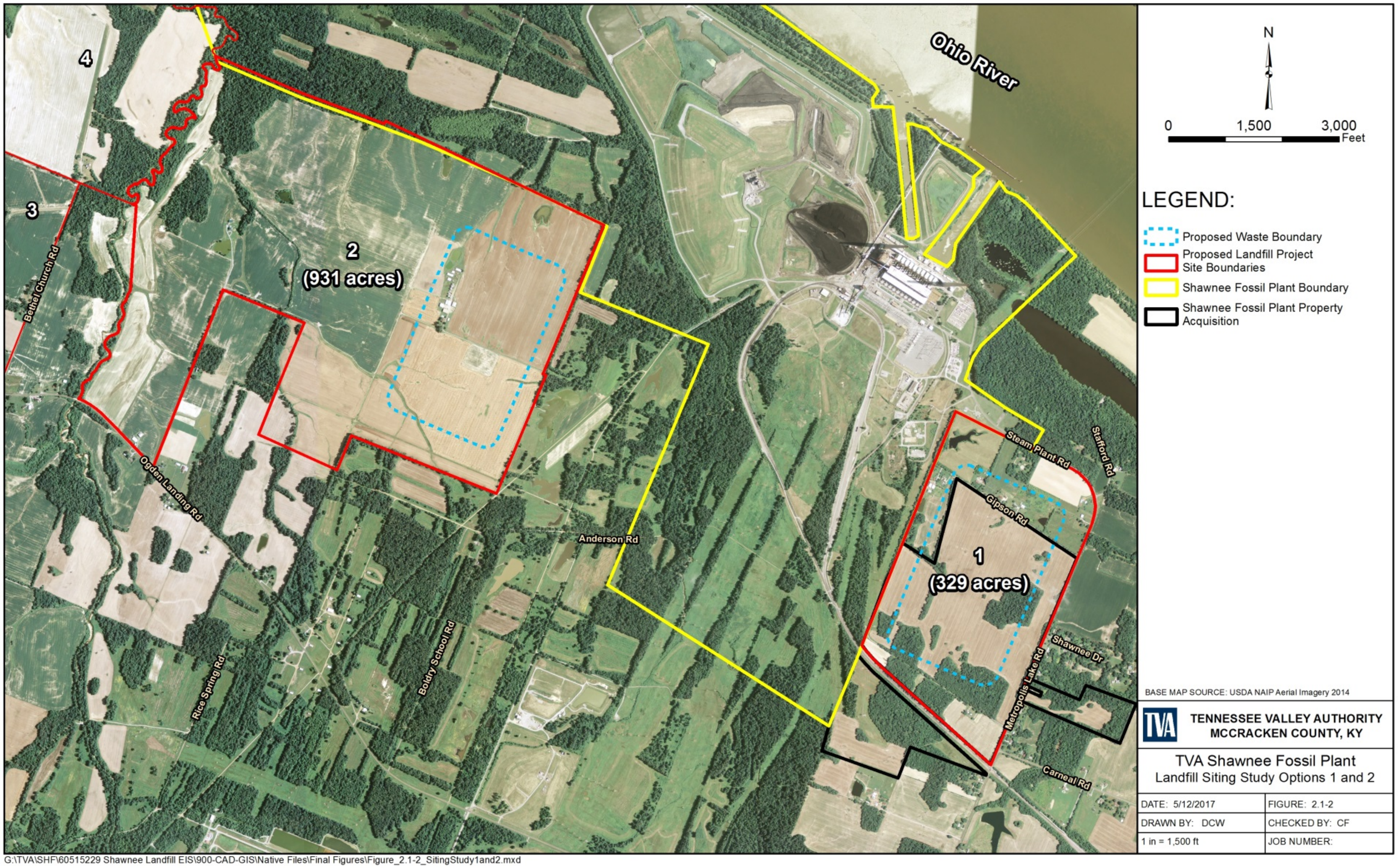


Figure 2.1-2. Landfill Siting Study Options 1 and 2

Figure 2.1-3. Landfill Siting Study Options 3, 4, and 5

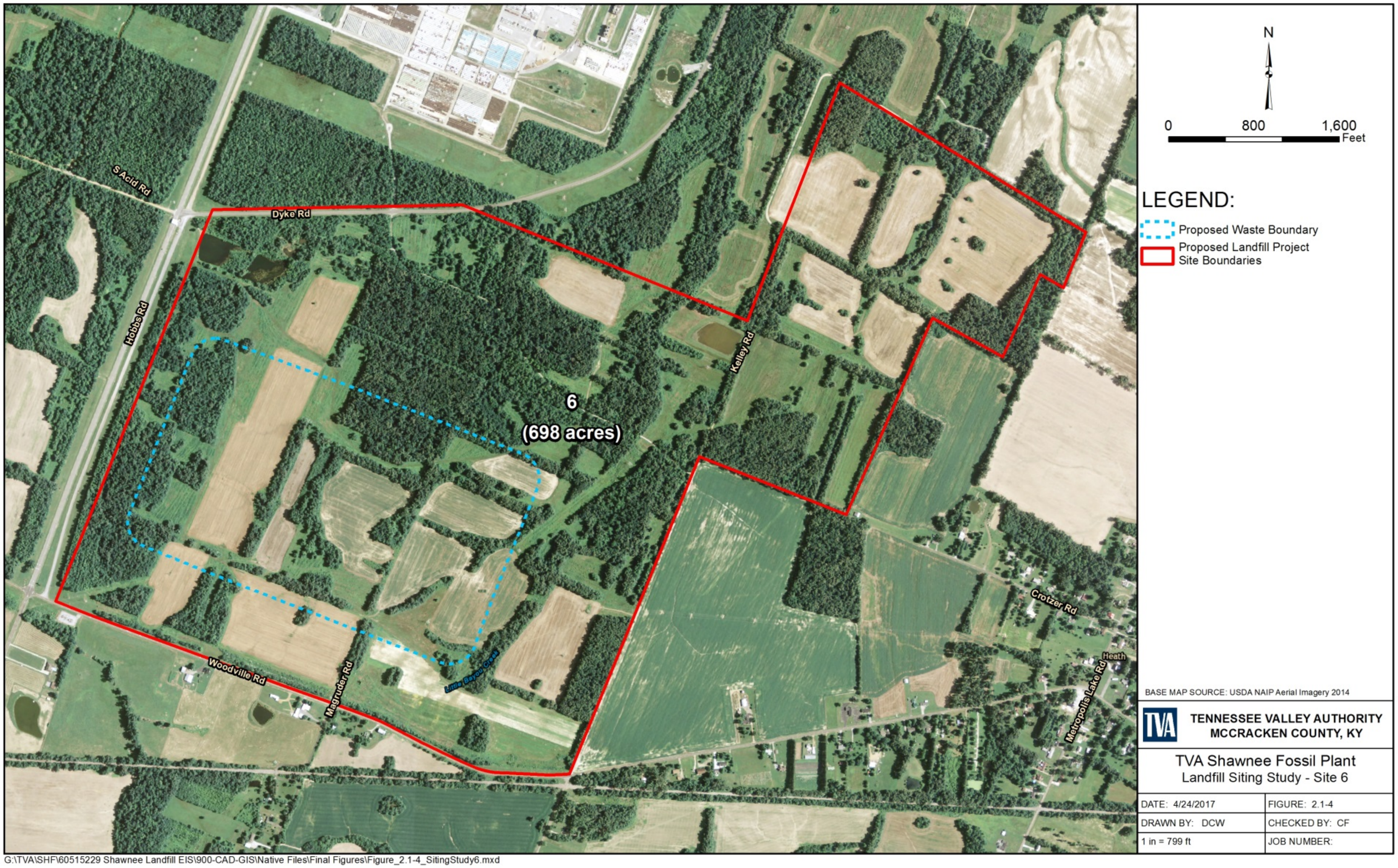


Figure 2.1-4. Landfill Siting Study Option 6

2.1.1.1.2 Option 2

Option 2 includes 935 acres owned by one landowner located southwest and adjacent to the SHF. There are wetlands and intermittent and perennial streams on the site. There are private wells on the property and on adjacent properties. The property lies partially within the 100 year floodplain; however, the floodplain could likely be avoided in the construction of the landfill. The McCracken Future Land Use Plan shows most of the site as Heavy Industrial and some as Agricultural. Much of the site appears to have been used for agriculture for a number of years. The site is located about 3.5 miles from an existing school, about 1.5 miles east of a church, and is directly adjacent to a natural area.

Some of the site was previously marketed for sale, however, after discussions, the owner indicated they were not willing to sell at the time TVA inquired; therefore, the site was eliminated from consideration due to lack of availability.

2.1.1.1.3 Option 3

Option 3 consists of 298 acres, comprised of two parcels with two owners, located approximately 7 miles southwest of the SHF property. There is a small area of wetlands and intermittent streams on the site. There are some private wells on the property and on adjacent properties. This property is not within the 100-year floodplain. The McCracken County Future Land Use Plan shows the site as Agricultural. The site is about 2.5 miles from an existing school, about 0.75 mile southwest of a natural area, and about a 0.5 mile east of a church.

The distance from the SHF generation point, and the lack of congruity with SHF property thus requiring transport of dry CCR over public roadways, rendered this site less desirable than Options 1 and 2. Additionally, the availability of this site was undetermined at the time of the evaluation. Because this site scored lower than Option 1, Option 3 was eliminated from further consideration.

2.1.1.2 Disposal of CCR in an Existing Offsite Permitted Landfill

In the landfill siting study, TVA also evaluated three potential offsite third-party existing permitted landfill alternatives (Figure 2.1-5). The siting study also considered transport of the dry CCR to the selected offsite third-party landfill via barge, rail, or truck. The three potential offsite landfill locations evaluated in the siting study include:

- *Freedom Waste (Western Kentucky) Landfill* is located in Mayfield, Kentucky. Access is via public roads and the distance to the point of generation is about 32 miles. The site size is over 350 acres with over 30 years of permitted airspace (Freedom Waste Service 2016). There is a nearby residential neighborhood and school. The owner quoted a tipping fee of $32/ton.

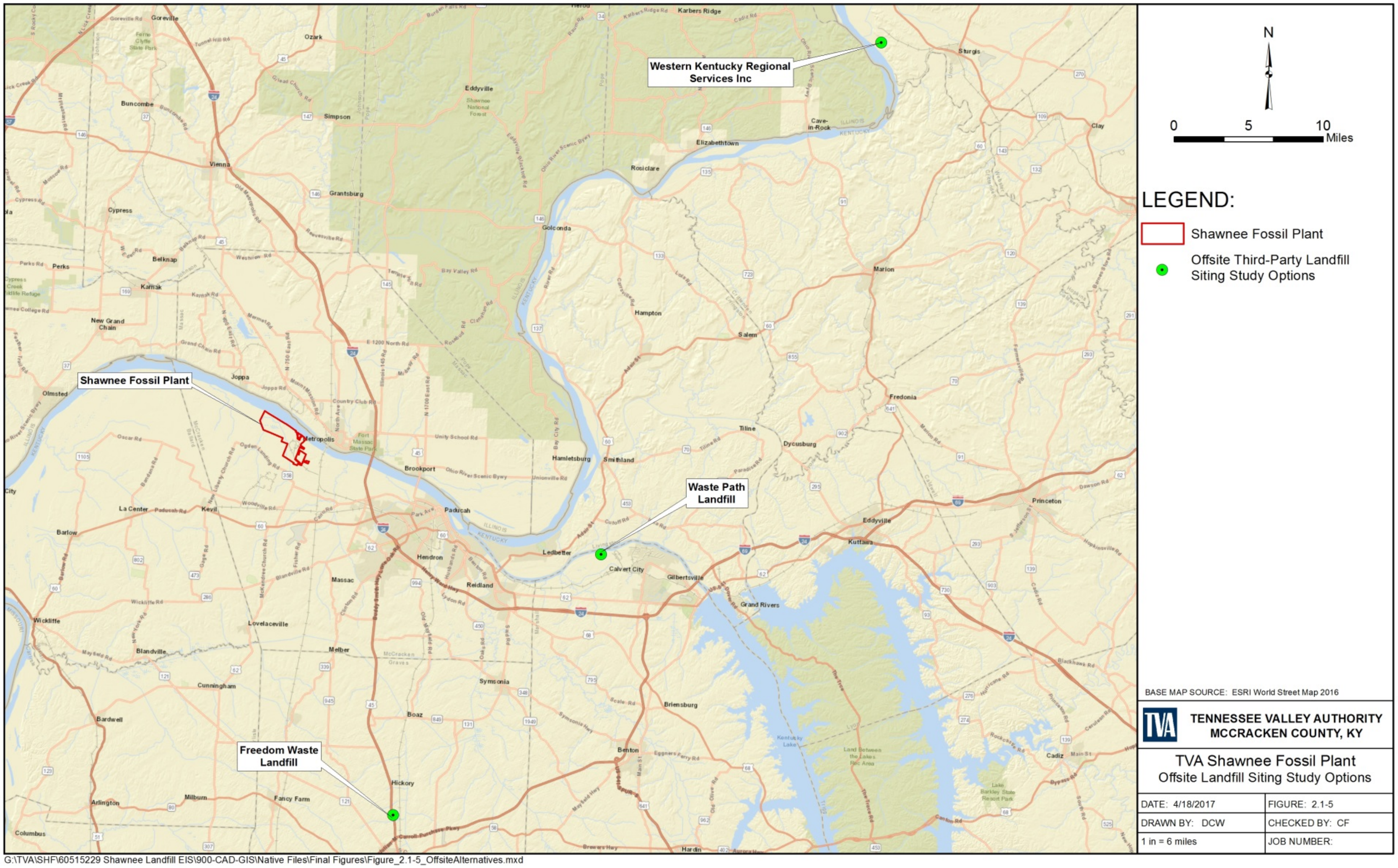


Figure 2.1-5. Offsite Landfill Siting Study Options

- *Western Kentucky Regional Services, Inc.* is located near Sturgis, Kentucky. The business has a permit to construct a new landfill and dispose of both municipal solid waste and CCR. No landfill disposal cells had been constructed at the time of completion of the siting study. The site is being marketed by the owner as a landfill with access by barge transport on the Ohio River. The distance from the Western Kentucky Regional Services landfill to the SHF point of generation is approximately 76 river miles or 92 road miles. The site occupies a total of 676 acres, 43 of which are ready for construction for an initial 4.25 million cubic yards of permitted disposal airspace that could be operational within one year. There is an existing barge loading facility on the site which would need to be modified for unloading of CCR from SHF. Additionally, a barge loading facility would need to be constructed at SHF. This is a rural site with no zoning. There are nearby residential properties. The owner quoted a tipping fee of $40/ton assuming 357,000 cubic yards per year for at least 12 years; this would include all costs after being loaded on the barge at SHF. The Western Kentucky Regional Services site was eliminated from consideration because landfill cells have not yet been constructed, the distance from the SHF generation point, the need to construct new barge loading facilities at SHF and unloading facilities at the landfill, and the estimated costs.
- *Waste Path Landfill* is located in Calvert City, Kentucky. Access is via public roads and the distance to the point of generation is about 32 miles. This is an existing third-party disposal site. The site is approximately 42 acres at present and the owner is considering a 60 acre expansion. The general tipping fee is $40 per ton. The Waste Path Landfill was eliminated from consideration due to the landfill size in comparison to the expected quantities of dry CCR generated by SHF and requiring disposal and cost.

The Freedom Waste Landfill was selected as the most viable alternative for offsite disposal because of its operational status, distance from the SHF generation point, and cost. Therefore, this option was carried forward for analysis in the EIS.

2.1.1.2.1 Landfill Siting Study Summary

Based on the evaluation described above, “Option 1”, located on approximately 330 acres east of and adjacent to SHF was identified as the most feasible option in the siting study (Stantec 2016).

2.1.1.2.2 Dry CCR Transport Options

As part of the siting study, TVA also considered three methods (barge, rail, or truck) to transport the dry CCR to the offsite landfill options. As described above, a barge offloading facility is present at SHF. However, to accommodate transport of dry CCR from SHF to an offsite landfill, the barge facility would have to be modified to allow for barge loading. Additionally, a barge unloading facility would be required at the offsite landfill. A quote of $3.10 per ton ($4.34 per cubic yard) was received from Crounse Corporation for barging the waste about 72 miles (to the Western Kentucky Regional Services landfill). This would be more than twice as expensive over the course of the project than development of a new CCR landfill at one of the siting study options. Therefore, barge transport was eliminated because of the cost considerations, the need to modify the barge facility at SHF, and because the preferred offsite landfill option does not have barge access.

Rail transport of CCR would entail the loading of railcars at SHF, transport of railcars to an offsite landfill, unloading, and trucking to the tipping face of the landfill. Additionally, the rail spur at SHF is utilized regularly for coal deliveries. It is possible that rail modifications would be required at SHF to avoid conflicts and delays between coal deliveries and dry CCR export. Additional costs could be entailed to install rail offloading facilities at the offsite landfills if not already present. TVA assumes the cost of rail transport would be no less than the cost of barging the dry CCR (approximately $4.34 per cubic yard as described above), and thus, would also be more than twice as expensive than construction of a new CCR Landfill at one of the siting study options or trucking CCR to the preferred offsite landfill. Therefore, rail delivery of dry CCR to an offsite landfill was eliminated because of cost considerations and the potential for rail logistics issues.

Because of the elimination of the barge and rail options for dry CCR transport, only the truck transport option was carried forward for analysis in this EIS. Trucking is the most technically feasible mode of transport because it uses the existing roadway infrastructure that already serves the plant site and the receiving landfill. Trucking is also more affordable than transporting the CCR by barge or rail.

2.1.2 Landfill Alternatives Retained for Detailed Analysis

2.1.2.1 Proposed New CCR Landfill Site (Siting Study Option 1 Modified)

Based on the evaluation described in Subsection 2.1.1.1, the approximately 330-acre “Option 1” site shown on Figure 2.1-2 was identified as the most feasible location for a new CCR Landfill. Approximately 205 acres of this property is carried forward in this EIS for evaluation as a borrow site and for locating the proposed CCR Landfill. This site is designated the Shawnee East Site (Figure 2.1-6). The Shawnee East Site is bounded on the north by Gipson Road, on the east by Metropolis Lake Road, on the south by the railroad, and on the west by SHF property.

In January 2017, TVA received permission from McCracken County to close Anderson road, which was accessible to the public.

Figure 2.1-6 shows the features of the proposed CCR Landfill at the approximately 205 acre Shawnee East Site located southeast of and adjacent to the original SHF property. The landfill would occupy approximately 88 acres in the center of the Site. The estimated capacity of the landfill is 8 million cubic yards, which would provide up to 20 years of disposal capacity based on SHF’s projected energy production. The landfill would be built in a series of three cells that can be developed over time as needed to a maximum height of approximately 100 feet. The remainder of the approximately 205-acre Shawnee East Site would be occupied by two 3-acre storm water ponds and a storm water outlet, one 2-acre leachate pond, an approximately 2-acre ancillary facility, an approximately 30-acre temporary construction area, and onsite roads.

Figure 2.1-6. Proposed New CCR Landfill at the Shawnee East Site

The approximately 88-acre CCR Landfill would be situated on the property to satisfy required buffers, and geographically to maximize storage volume. The precise location of the landfill could be adjusted after completion of ongoing investigations, design, and planning. Development and operation of the landfill would include:

- Acquiring new and or modifying existing local, state, and federal permits (e.g., site BMP plan, KPDES, 401/404, Title V Air Permit, and a Registered Permit-by-Rule;
- Completing the hydrologic/geotechnical exploration;
- Sampling groundwater monitoring wells;
- Designing and developing construction and operations plans;
- Constructing the landfill cells (in stages);
- Operation and maintenance activities;
- Disposing of dry CCR into the landfill cells; and
- Eventual closure of the CCR Landfill once capacity is reached and final grade is met.

The CCR Landfill would be designed and constructed to meet CCR rule, and any KDWM requirements for new landfills. To meet these requirements, the following components are proposed:

1. Composite Liner System. The proposed composite liner system would consist of the following components (or equivalent):
    - 5 feet of geologic buffer material if necessary to achieve separation from the uppermost aquifer
    - 2-foot layer of low permeability liner material (maximum permeability of 10^7 centimeters per second)
    - 60-mil HDPE flexible membrane liner
    - Geocomposite drainage layer
    - Protective Cover (CCR material or sand)
2. Groundwater Monitoring Network
    - A groundwater monitoring network will be installed to meet the EPA CCR rule and any state requirements.
    - Quarterly baseline sampling of the groundwater monitoring wells is planned to be conducted prior to waste being placed in the CCR landfill.
    - Groundwater will be analyzed for the parameters required in the EPA CCR rule.
    - Semi-annual sampling will occur following placement of waste, and will continue 30 years after closure of the landfill.

3. Leachate Collection and Treatment System
    - A leachate collection system designed to facilitate the free drainage of leachate would be provided immediately above the liner. Collected leachate would be handled separately from contained surface runoff and would be sent to the onsite, lined leachate pond, then on to a lined Process Water Basin(s) where it would be conveyed to the Ohio River through a KPDES permitted outfall.
    - The leachate collection system would be capable of removing leachate from the landfill during its active life and the 30-year post-closure period.
4. Storm Water Management
    - New perimeter drainage ditches will be constructed to convey storm water runoff from the new landfill area to two storm water ponds. The storm water ponds would discharge to the unnamed tributary to Little Bayou Creek through a new permitted outfall. Drainage structures including ditches, benches, and culverts would be designed using standards outlined in the Final CCR Rule.
5. Final Cover System. The proposed final cover design will be developed in accordance with the CCR Rule, and is anticipated to consist of the following components:
    - Textured 40-mil linear low-density polyethylene flexible membrane liner
    - Geocomposite drainage layer
    - Protective soil cover (18-inch layer from borrow materials obtained onsite)
    - Vegetative cover (6-inch layer)

A summary of the primary characteristics of the proposed CCR landfill during both construction and operation is included in Table 2.1-1.

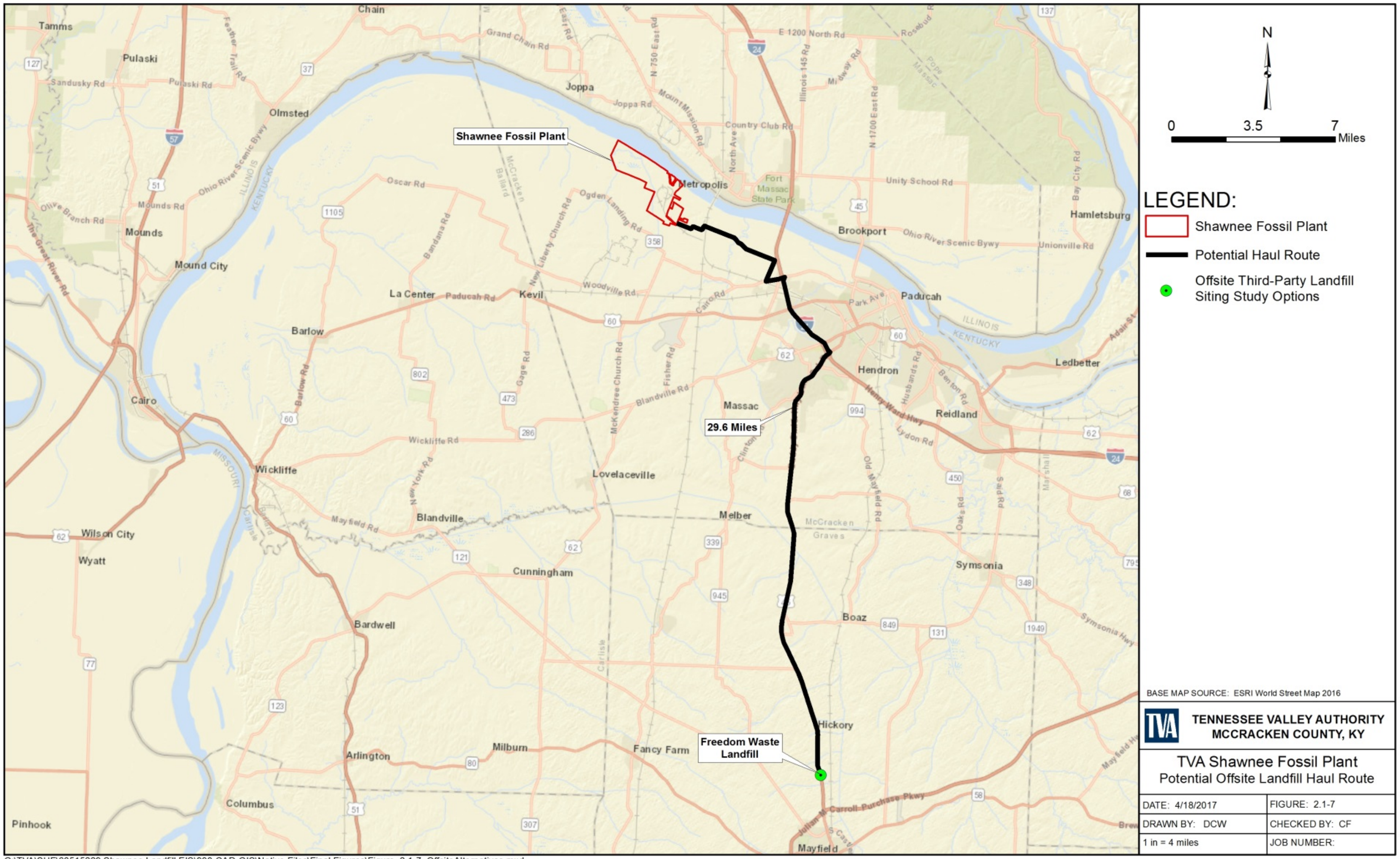
The Shawnee East Site would be used for borrow material for the new CCR Landfill, the closure of Ash Impoundment 2, and the closure of the former SWL discussed in Section 2.2 below. Borrow material would be removed from the approximately 205-acre project area shown in Figure 2.1-6 as needed throughout the course of the project.

Table 2.1-1. Primary Characteristics Related to Construction and Operation of a New CCR Landfill at SHF

Project Features	Characteristic	Value
Construction	Limits of disturbance (includes leachate pond, storm water ponds, storm water and leachate conveyances, temporary construction areas, and borrow area)	~205 acres
Capacity	Total capacity (constructed in a series of three cells)	~8 million cubic yards
Limit of Waste	Landfill footprint	~88 acres
Stability	Recommended measures to support stability	TVA would conduct a stability analysis and develop exact measures based on site-specific conditions.
Height	Maximum height of landfill relative to access roads	~100 feet
Leachate Management	One leachate pond	Discharge to Ohio River through an existing KPDES permitted outfall
Storm Water Management	Two ponds	Storm water ponds would discharge to an unnamed Tributary of Little Bayou Creek and then to the Ohio River.
Employment Workforce	Construction Operations	~35 workers ~5 workers
Projected Ash Production	Dry CCR to be managed in the landfill	Based on the future generation plan for SHF, the dry CCR production is estimated to be approximately 490,000 to 910,000 cubic yards per year from 2020-2040.
Transport Distance	Distance from the dewatering facilities to the new CCR Landfill	~2.5 miles one way; ~5 miles round-trip
Articulated dump truck traffic volume	Number of fully loaded truckloads needed to haul CCR from the dewatering facilities to the proposed landfill via a private onsite haul road	~95-175 truckloads per day. Equates to a traffic count of 190 to 350 trips per work day or approximately 10 to 20 trucks per hour.

2.1.2.2 Offsite Disposal of Dry CCR in an Existing Permitted Landfill (Freedom Waste Landfill)

Based on the preliminary evaluation as described in Subsection 2.1.1.2, TVA selected Freedom Waste Landfill in Mayfield, Kentucky as the most viable offsite landfill option. Freedom Waste Landfill is analyzed as part of Alternative C (Figure 2.1-7). Access is via public roads and the distance from SHF to the landfill is about 32 miles. The landfill site size is over 350 acres with over 30 years of permitted airspace (Freedom Waste Service 2016). The dry CCR would be transported to Freedom Waste Landfill via truck along public roadways. The approximate transport route is shown in Figure 2.1-7. TVA estimates SHF would produce approximately 9,400 to 17,500 cubic yards of CCR per week. As described in Subsection 2.1.2.1, transporting this dry CCR from SHF to the Freedom Waste Landfill would require a total of 190 to 350 truck trips per day, based on a typical 5-day work week.



G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Final Figures\Figure_2.1-7_OffsiteAlternatives.mxd

Figure 2.1-7. Potential Haul Route to the Freedom Waste Landfill

2.1.3 Ash Impoundment 2 and Former Special Waste Landfill Closure

2.1.3.1 Programmatic Environmental Impact Statement

A portion of this SHF CCR Management EIS will be a site-specific analysis tiered from TVA's *Ash Impoundment Closure Final Environmental Impact Statement Part I Programmatic Review (PEIS)* issued in July 2016. The Record of Decision for the PEIS concluded that future environmental reviews of CCR impoundment closures at TVA facilities could tier from the PEIS if the impoundments fit into the framework established in the PEIS. Figure 2.1-8 provides the conceptual framework used to evaluate ash impoundment closures to determine if the conclusions reached from the PEIS would be applicable to the proposed impoundment closures at SHF.

The PEIS addressed the programmatic closure of CCR impoundments at TVA's coal plants and the environmental effects of two primary ash impoundment closure methods:

- *Closure-in-Place* involves stabilizing the CCR in place and installing an approved cover system that virtually eliminates rainfall from entering the impoundment. This can also include consolidation within the existing cell.
- *Closure-by-Removal* involves excavating and relocating the CCR from the ash impoundment in accordance with federal and state requirements to an approved onsite or offsite disposal facility. The CCR may also be beneficially used in products or structural fills.

At the programmatic level, TVA concluded (as EPA did in the CCR Rule) that both closure options can be equally protective of human health and the environment, provided that they are implemented properly. In most situations, Closure-in-Place is expected to be more environmentally beneficial and less costly than Closure-by-Removal, especially when the amount of CCR material that must be moved from the site exceeds 600,000 cubic yards and the amount of borrow that needs to be delivered to the site exceeds 200,000 cubic yards.

For Closure-in-Place, TVA's analysis also confirmed EPA's determination that dewatering and capping impoundments would reduce groundwater impacts and structural stability risks because the hydraulic head (water pressure) would be reduced. Compared to Closure-by-Removal, this alternative would have significantly fewer risks to workforce health and safety and those related to offsite transportation of CCR (crashes, road damage, and other transportation-related effects).

Closure-by-Removal would reduce groundwater impact risks more than Closure-in-Place over the long term when CCR intersects with groundwater because CCR material would be excavated and moved to a permitted landfill. However, this alternative would result in notably greater impacts associated with other environmental factors (e.g., air quality, noise) and would increase the potential for impacts on worker-related and transportation-related health and safety.

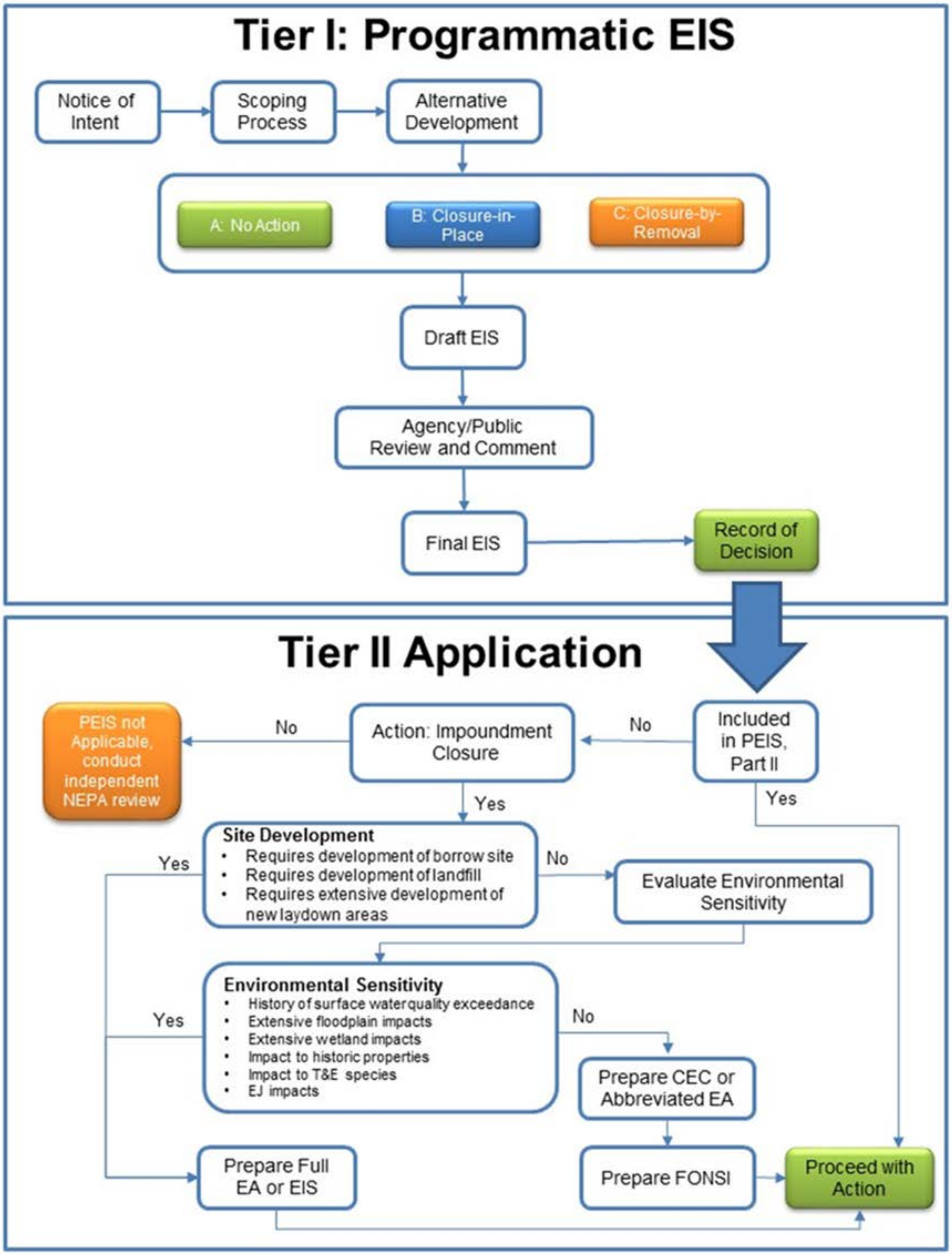


Figure 2.1-8. Tiered NEPA Process for TVA Ash Impoundment Closure

In guidance on the CCR Rule, the EPA has stated that dewatering and leaving CCRs in place may offer potential environmental benefits through the elimination of "significant truck traffic that would accompany offsite disposal of CCRs" (EPA 2017). EPA also suggests that onsite CCR consolidation can "provide for greater land use options and flexibility". In-place waste consolidation can also allow a long-term focus on monitoring, care, and cleanup in a single location rather than multiple locations (EPA 2017).

As a result of the analysis in the PEIS and consideration of the EPA's recent statements, TVA concluded Closure-in-Place achieves the purpose and need of closing the ash impoundment and former SWL within the five-year closure period, can be completed in a much shorter timeframe than Closure-by-Removal, and avoids offsite transfer of CCR and the associated impacts.

2.1.3.2 EPRI Relative Impact Framework

As was described in Part I, Section 2.3 of the PEIS, Electric Power Research Institute (EPRI) has developed a comprehensive analytical tool, the "Relative Impact Framework" (RIF) to assess and compare the potential health and environmental impacts of the two CCR impoundment closure alternatives, Closure-in-Place and Closure-by-Removal (EPRI 2016). EPRI qualitatively applied its RIF to specific CCR facilities that TVA proposed to close in Part II of the PEIS. EPRI's site-specific analyses confirmed TVA's programmatic conclusions about the merits of and relative differences between the two closure methods.

2.1.3.3 Tiering from the PEIS

This section considers the applicability and appropriateness of the ash impoundment closures at SHF for second tier NEPA analysis under the PEIS. As such, this analysis considers both the characteristics of the former SWL and Ash Impoundment 2 being considered for closure, and the nature of activities proposed under the closure action. Substantial deviations in either the impoundment characteristics or the type and extent of proposed actions to conduct closure could either demonstrate the inapplicability of tiering or necessitate additional specialized site-specific analyses.

Although the former SWL is not an ash impoundment, given its location with respect to Ash Impoundment 2 and the former footprint of Ash Impoundment 1, as well as the similarity in closure activities/methods, TVA has deemed it appropriate to tier closure of the former SWL from the PEIS.

Recognizing the potential pathways for exposure and risk related to existing ash impoundments, TVA developed a series of factors important in the screening and evaluation of project alternatives to determine whether an alternative is a "reasonable" action. Applicability of the closure of impoundments at SHF to these screening factors considered in the PEIS is shown in Table 2.1-2.

Table 2.1-2. Factors Evaluated to Determine Reasonability of Closure Activities in the PEIS and Related Attributes of the Impoundments at SHF

Screening Factor	Programmatic Attribute	SHF Characteristics
Volume of CCR Materials	The size of an ash impoundment and volume of CCR affect closure activities, potential environmental impacts and cost. CCR volume within ash impoundments considered in the PEIS ranged from 10,000 to 25 million yd^3.	Volumes of CCR in the ash impoundments at SHF are: • Ash Impoundment 2 = 3.5 million yd^3 • Former SWL = 22.5 million yd^3
Schedule/ Duration of Closure Activities	Time necessary to complete closure activities at an ash impoundment affects the reasonability of closure alternatives. The range of closure durations determined in the PEIS were as follows: • Closure-in-Place: Less than 5 years • Closure-by-Removal: 2.7 years to 170 years	Based upon analyses of the PEIS and the total volume of CCR, the ash impoundments at SHF could be closed concurrently within 5 years using Closure-in-Place. Time to close each impoundment using Closure-by-Removal is as follows: • Ash Impoundment 2[1] = 21-23 years o Former SWL[2] = 72-79 years
Stability	TVA is currently evaluating the seismic stability of all CCR facilities and will make appropriate modifications to ensure that the berm stability is at a level that meets or exceeds industry safety factors using conservative assumptions. The proposed closure grades of the facilities will be evaluated prior to construction, and any needed improvements to the berms will be made as part of the closure system construction.	TVA has evaluated the stability for Ash Impoundment 2 in compliance with the CCR Rule. Height would not be added to the existing stack; the final configuration would be within the factors for static stability and in compliance with all regulations.

[1] Calculated based on the assumptions in the PEIS: removal by truck assumes an average of up to 100 truckloads of CCR per day hauling 10 cubic yards (yd^3) per load, 9 hours a day, for approximately 150 days per year (based on the need to dewater and dry the ash before transport"); removal by rail assumes 11 rail cars per day carrying 100 yd^3 per car approximately 150 days per year.
[2] Calculated based on the assumptions of an average of up to 120 truckloads of dry CCR per day hauling 10 cubic yards (yd^3) per load, 9 hours a day. The former SWL would be removed approximately 260 days per year. Removal by rail assumes 11 rail cars per day carrying 100 yd^3 per car approximately 260 days per year.

Table 2.1-2. Factors Evaluated to Determine Reasonability of Closure Activities in the PEIS and Related Attributes of the Impoundments at SHF

Screening Factor	Programmatic Attribute	SHF Characteristics
Risk to Human Health and Safety Relating to Closure Activities	Closure activities entail a range of construction activities that represent a potential risk to the health and safety of the workforce and the public. Excavations associated with the Closure-by-Removal alternative are particularly dangerous as noted by reports of accidents leading to injury or death in the industry. As discussed in the PEIS, sites having large volumes of CCR that are considered for Closure-by-Removal would also result in extensive trucking operations that would increase transportation risks.	TVA considered worker safety in the evaluation of closure options for the impoundments at SHF. Closure-in-Place minimizes impacts associated with onsite worker safety by avoiding excavations and public safety related to the transport of large volumes of CCR on public roadways over extensive periods of time.
Surface Water Resources	Consistent with EPA's determination in the CCR Rule and the results of the EPRI model, TVA anticipates that surface water impacts would be reduced under the Closure-in-Place alternative when the hydraulic head is removed and the facilities are capped. Removal of potential additional hydraulic inputs from precipitation, surface water runoff or other water additions to the impoundment through the capping process will effectively reduce and control and minimize impacts to surface water resources.	Ash Impoundment 2 at SHF would be dewatered as appropriate and all remaining CCR material would be consolidated and compacted and covered with an approved cover system. In conjunction with impoundment closure activities, all systems currently discharging to the impoundment would be rerouted to other systems at the site. CCR may be excavated from Ash Impoundment 2 to achieve the desired grade. This material would be transported to other areas of Ash Impoundment 2. New Process Water Basin(s) would be constructed as part of the project actions.
Groundwater Resources	Both Closure-in-Place and Closure-by-Removal reduce groundwater impacts. While Closure-by-Removal would reduce groundwater impacts more than Closure-in-Place over the long term, Closure-in-Place still reduces impacts in such situations. EPA considers both closure options equally protective of human health and the environment.	No records of releases or issues of concern are known that represent a risk to human health from CCR constituents associated with the existing impoundments. In addition to any federal requirements that may apply to the impoundments at SHF after closure is completed, TVA will implement supplemental mitigation measures as required by the KDEP, as well as its approved closure plan, which could include additional monitoring, assessment, or corrective action programs. However, as noted in the PEIS, TVA expects any groundwater impacts to be notably reduced following impoundment closure.

Table 2.1-2. Factors Evaluated to Determine Reasonability of Closure Activities in the PEIS and Related Attributes of the Impoundments at SHF

Screening Factor	Programmatic Attribute	SHF Characteristics
Wetlands	Analyses presented in the PEIS determined that for both Closure-in-Place and Closure-by-Removal alternatives, proposed actions would not cause or contribute to significant degradation of wetlands because laydown areas were minimized and wetlands are generally lacking from ash impoundments. Additionally, appropriate measures could be taken to avoid and minimize or compensate for impacts to wetlands and ensure no net loss of wetlands.	No jurisdictional wetlands are located in the footprints of Ash Impoundment 2 or the former SWL at SHF or any associated laydown areas.
Risk to Other Adjacent Environmental Resources	The analyses performed as part of the PEIS determined that risk of potential release and degradation of environmental resources (cultural resources, ecological receptors, and factors related to the human environment) was generally low for both Closure-in-Place and Closure-by-Removal alternatives. However, potential air and noise emissions were expected to be markedly greater for the Closure-by-Removal alternative due to offsite transport and trucking operations.	Potential areas of disturbance associated with impoundment closure at SHF would be largely confined to previously disturbed lands. Additionally, no adjacent sensitive receptors are located proximate to ash impoundments at SHF.
Mode and Duration of Transport Activities – Trucking	For those sites with CCR volumes exceeding 600,000 cubic yards, TVA determined that insufficient time is available within the construction schedule to effectively remove the CCR materials by truck or rail and achieve closure of impoundments within the 5-year period for closure.	The volume of CCR to be removed from the CCR impoundments at SHF ranges from 6 million yd^3 at Ash Impoundment 2 and 20.6 million yd^3 at the former SWL. Based upon analyses of the PEIS and the total volume of CCR, the ash impoundments at SHF could be closed in place within 5 years, whereas Closure-by-Removal of the impoundments ranges from 21-23 years for Ash Impoundment 2, and 72-79 years total for the components of the former SWL.

Table 2.1-2. Factors Evaluated to Determine Reasonability of Closure Activities in the PEIS and Related Attributes of the Impoundments at SHF

Screening Factor	Programmatic Attribute	SHF Characteristics
Risk to Human Health and Safety Related to Transport of Borrow and CCR	Transport of borrow or CCR by truck increases transportation risks. As the number of truck movement miles increase, the risk of traffic crashes increases, including personal injuries and fatalities. Transport of CCR materials must consider a range of factors that determine reasonableness and environmental impact including the volume of CCR materials to be removed (cost-effectiveness and duration of removal operations), logistics related to supporting infrastructure (loading and unloading facilities), the availability of off-loading terminals at receiving landfills, increased risk of injuries and death, and increased potential for accidental release.	Under Closure-by-Removal TVA estimates it would require 1820 truckloads per day to accomplish removal within a 4-year closure period to the nearest Subtitle D landfill. It is estimated that this would equate to approximately 202 loaded trucks passing by a given location each hour (3.4 trucks per minute). This is not feasible because of loading times and road capacity. For extended duration of normal removal operations, TVA estimates at an average of 100 trucks per day, 150 days per year for Ash Impoundment 2 and 120 trucks per day 260 days per year for the former SWL. It would require approximately 72-79 years to complete Closure-by-Removal.
Excessive Cost	Excessive closure costs may affect the reasonableness of an alternative. Costs for Closure-by-Removal by truck were demonstrated to be 168 to 2,390 percent greater than Closure-in-Place alternatives at the sites evaluated in the PEIS.	Estimated closure costs for Closure-in-Place of the impoundments at SHF: • Ash Impoundment 2 = \$32,905,000-\$66,829,000 • Former SWL = \$65,200,000-\$121,894,000 Estimated closure costs for Closure-by-Removal of the impoundments at SHF: • Ash Impoundment 2 = \$167,993,000-\$705,741,000 • Former SWL = \$237,971,000-\$1,525,684,000 Costs of Closure-by-Removal are estimated to range from 311 percent to over 1082 percent higher than the cost of Closure-in-Place.

As shown in Table 2.1-2, the characteristics of Ash Impoundment 2 and former SWL closures at SHF would be bounded by the analysis in the PEIS. Therefore, TVA has determined that it is appropriate to tier the NEPA analysis of the impoundment closures proposed at SHF from the PEIS.

The following sections examine the SHF site-specific analysis for Closure-in-Place and Closure-by-Removal.

2.1.3.4 Closure of Existing Special Waste Landfill and Closure of Ash Impoundment 2

In 2015, TVA issued the *Shawnee Fossil Plant SWL and Ash Impoundment 2 Final Closure Projects Project Planning Document* (PPD; Stantec 2016a). In this preliminary project planning analysis, TVA considered several alternatives for closure of the former SWL and Ash Impoundment 2 at Shawnee (Table 2.1-3). Alternatives were evaluated based on potential cost, constructability issues, risks, and environmental considerations. The alternatives in the PPD were considered based on the following assumptions:

- As of 2015, the planned production of CCR materials until 2022 was estimated at 3,800,000 cubic yards. This additional material was assumed to be stacked within the Ash Impoundment 2/former SWL consolidation area so as not to require re-handling to achieve final closure grade.
- For in-place closure alternatives, both geomembrane cap and soil cap systems were evaluated.
- The planned Process Water Basin(s) (for handling bottom ash dewatering and other plant effluent flows) was assumed to be approximately 10 to 25 acres in size. The existing stilling pond and active ash impoundment may be lined and used for general plant flows (non-CCR). The new basin(s) would be lined with geomembrane, with a location not yet determined.
- Dewatering Ash Impoundment 2 and stabilization of sluiced ash would be required in areas where ponding is currently present. At a minimum, construction of a working platform would be required in dewatered ash areas where placement of material is planned.
- As a seismic risk reduction measure TVA has limited stacking to active areas below the current top of the former SWL stack. The height of the stack will not be elevated higher than at present (Stantec 2016a).

Table 2.1-3. Former SWL and Ash Impoundment 2
Project Planning Document Closure Alternatives (Stantec 2016a)

Alternative	Description	Analysis Recommendation
Alternative 1a: Ash Removal of Both Facilities and Hauling to the New Onsite CCR Landfill	Under Alternative 1a the CCR material from the former SWL and Ash Impoundment 2 would be hauled to the new onsite CCR Landfill currently being evaluated/designed. TVA estimates the former SWL and Ash Impoundment 2 would contain about 30,900,000 cubic yards of CCR by 2022 (the approximate time it would take to construct a new landfill). The new CCR Landfill envisioned under Option 1 above would not be large enough to accommodate this material based on the current proposed location and design. Cost estimate: ~$512,379,000.	This alternative was eliminated based on the outcome of the PEIS analysis which is described above. Additionally, the new CCR Landfill would not be large enough to accommodate this material and the material produced by ongoing operations at SHF.
Alternative 1b: Ash Removal of Both Facilities and Hauling by Truck to a Municipal Landfill	Under Alternative 1b the CCR material from the former SWL and Ash Impoundment 2 is hauled to a permitted municipal landfill by truck. It was assumed a lined landfill would be required to accept the CCR materials and the closest lined landfill is approximately 30 miles from the plant. Truck traffic to a municipal landfill would be extensive and would result in highway deterioration, traffic congestion, and possible environmental risks resulting in community issues. Cost estimate: ~$2,231,425,000.	This alternative was eliminated based on the outcome of the PEIS analysis including the time requirement to remove the CCR from Ash Impoundment 2 and the former SWL (approximately 86 years by truck), and the environmental risks and impacts (public safety, noise, air quality, road deterioration) associated with such removal. This was also the most expensive option.
Alternative 1c: Ash Removal of Both Facilities and Hauling by Barge to a Municipal Landfill	Alternative 1c is similar to Alternative 1b with the exception that the CCR material from the former SWL and Ash Impoundment 2 is hauled to a municipal landfill by barge. Cost estimate: $2,003,850,000.	This alternative was eliminated based on the outcome of the PEIS analysis, the lack of barge loading facilities at SHF, the lack of barge unloading facilities at Freedom Waste Landfill, and cost.
Alternative 2: Closure-In-Place by Reduced Footprint of Ash Impoundment 2 and In-Place Closure of Former SWL	Alternative 2 consists of Closure-in-Place and consolidation of Ash Impoundment 2 and the former SWL. This includes dewatering and hauling some of the ash located in the west end of Ash Impoundment 2 into the consolidated footprint of Ash Impoundment 2 and the former SWL. Cap options include a geomembrane cap system (40-mil geomembrane, geocomposite drainage layer, 18-inches of protective cover) or a soil cap system (20-inches of low permeability clay and 6-inches of vegetative cover). Cost estimate: ~$98,105,000.	This is the preferred alternative and is carried forward for analysis in this EIS.

Table 2.1-3. Former SWL and Ash Impoundment 2
Project Planning Document Closure Alternatives (Stantec 2016a)

Alternative	Description	Analysis Recommendation
Alternative 3a: Ash Removal of Former SWL to New CCR Landfill and Ash Impoundment 2 and In-Place Closure of Ash Impoundment 2	Alternative 3a consists of dewatering and stabilizing ponded areas within Ash Impoundment 2 followed by removing the CCR material in the former SWL south of the original Ash Impoundment 2 boundary. The CCR material removed from the southern portion of the former SWL would be hauled and placed within Ash Impoundment 2. Due to the limited space available for stacking within the Ash Impoundment 2 area, a portion of the CCR would also be hauled to the new CCR Landfill. A new perimeter dike would be constructed along the southern boundary of Ash Impoundment 2 and any landfill support structures would be removed. Placement of ash within Ash Impoundment 2 would follow a new grading plan requiring new permitted vertical and horizontal stacking boundaries. A permit modification for the vertical and horizontal waste boundaries would be required to place CCR material within Ash Impoundment 2. Cost estimate: ~$301,469,000.	This alternative was eliminated because it would create stability issues.
Alternative 3b: Ash Removal of Former SWL and Haul to New CCR Landfill, and In-Place Closure of Ash Impoundment 2	Alternative 3b is similar to Alternative 3a with the exception that all of the CCR material removed from the former SWL would be hauled to the new CCR Landfill. To provide material for general grading within the Ash Impoundment 2 area, soil fill would also be imported followed by in-place closure as described previously. TVA estimates the former SWL would contain about 18,000,000 cubic yards of CCR by 2022. Cost estimate: ~$402,499,000.	This alternative was eliminated because the new CCR Landfill would not be large enough to contain this material as well as the material generated by ongoing operations at SHF.
Alternative 3c: Ash Removal of Former SWL and Haul to Municipal Landfill by Truck, and In-Place Closure of Ash Impoundment 2	Alternative 3c is similar to Alternative 3b with the exception that the CCR material from the former SWL is hauled to a municipal landfill by truck. It was assumed a lined landfill would be required to accept the CCR materials and the closest lined landfill is approximately 30 miles from the plant. Cost estimate: ~$1,401,525,000.	This alternative was eliminated because the construction schedule and costs would be greater than the proposed alternative. It is also likely that as described for Alternative 1b there would be potential impacts to transportation resources, the environment, and the community.

Table 2.1-3. Former SWL and Ash Impoundment 2 Project Planning Document Closure Alternatives (Stantec 2016a)

Alternative	Description	Analysis Recommendation
Alternative 3d: Ash Removal of Former SWL Haul to Municipal Landfill by Barge, and In-Place Closure of Ash Impoundment 2	Alternative 3d is similar to Alternative 3c with the exception that the CCR material from the former SWL is hauled to a municipal landfill by barge rather than truck. Cost estimate: ~$1,269,269,000.	This alternative was eliminated because the construction schedule and costs would be greater than the preferred alternative. As with Alternative 1b there would be potential impacts to transportation resources, the environment, and the community.
Alternative 4a: In-Place Closure of Both Facilities with Redistribution of CCR Material	Alternative 4a consists of dewatering and stabilizing ponded areas within Ash Impoundment 2 followed by re-grading the former SWL by redistributing CCR within the footprints of both facilities. A permit modification for a horizontal and vertical expansion to place CCR material outside the limits of the current former SWL boundary would be required for this alternative. This is in addition to the permitting needed for the final cap system, alternative working platform, and new outfall along the southwest portion of the former SWL. Cost estimate: ~$173,818,000.	This alternative was eliminated because it will not improve stability. Additionally, significant permitting may be required resulting in a risk of design issues, delays, and increased costs.
Alternative 4b: In-Place Closure of Both Facilities with General Grading within Permit Boundary	Alternative 4b consists of dewatering and stabilizing ponded areas within Ash Impoundment 2 followed by general grading within the footprint of both facilities to promote drainage. Permitting would include modifications for the final cap system, a potential alternative working platform and permitting associated with a new outfall along the southwest portion of the former SWL. Updates associated with the final configuration varying from the permitted configuration would be addressed in the closure plan. Cost estimate: ~$155,993,000.	This alternative was eliminated because it will not improve stability.

2.1.3.4.1 Closure-by-Removal

As described in the table above, alternatives that included Closure-by-Removal were eliminated from detailed consideration for Ash Impoundment 2 and the former SWL as it was determined to be unreasonable for logistical, environmental, and economical reasons using the screening factors described in Table 2.1-2. Key factors contributing to this determination included:

- Excessive volume of CCR materials. At SHF, an estimated 26.6 million cubic yards would have to be removed.
- Removal of CCR by rail was considered by TVA for Closure-by-Removal of the Ash Impoundments. In Part I, Chapter 2.0 of the PEIS, TVA identified factors to determine whether transport of CCR by rail would be reasonable. Those factors included volume of material; distance from the impoundment to a permitted landfill; availability of the infrastructure to manage the transfer of material; cost effectiveness; and schedule. Applying those factors to the removal of CCR from the Ash Impoundments, transport by rail is unreasonable due to the cost and closure schedule. Rail transport would require the installation of loading infrastructure, and a rail transportation service in the form of a rail carrier. Additional rail infrastructure may need to be constructed at or very near a Subtitle D landfill. The components of the rail loading infrastructure may include: clamshell buckets to move the CCR off the train to a stockpile area prior to being placed on trucks and conveyors or loaders to load the CCR onto trucks; and infrastructure to support trucking to the landfill site. The necessary environmental and construction permits to construct these facilities could easily take 18 to 24 months to acquire. The specs from the removal of CCR by rail to an offsite landfill after the Kingston Fossil Plant spill in 2008 (15,000 yd^3 per day) were used to estimate the length of time it would take to remove CCR by rail from SHF. Given the large volume of CCR materials at the SHF impoundment (~26.6 million cubic yards), it would take approximately 79 years to transport CCR by rail (150 days per year for Ash Impoundment 2 and 260 days a year for the former SWL respectively) making this transport option infeasible. The time, costs, and environmental impacts associated with use of rail to transport CCR from SHF make this option infeasible.
- While the CCR Rule specifies a 5-year closure window, it is anticipated that up-front permitting and planning will take 6 months and post-closure site restoration and permit close-out will take 6 months. Thus, a 4-year window is used for the timeframe for hauling of CCR from the site. It would require 1820 truckloads per day to accomplish removal of SHF's 26.6 million cubic yards within a 4-year closure period to the nearest landfill. It is estimated that this would equate to approximately 202 loaded trucks passing by a given location each hour (3.4 trucks per minute). This is not feasible because of loading times and road capacity.
- Extended duration of removal operations (estimated to be 86 years of trucking at 100 trucks per day. Removal would occur 150 days per year for Ash Impoundment 2 due to the need to dewater and dry the ash. Removal would occur 260 days per year for former SWL.

- Excessive removal cost ranging from approximately $512 million to $2.2 billion (includes CCR excavation and transport, borrow transport, and placement; see Table 2.1-3 for costs per specific removal method).
- The PEIS's observations about safety, air, and noise emissions, environmental justice, and berm stability would apply equally to SHF.

In addition, under Closure-by-Removal, CCR would be removed and placed in an appropriate receiving landfill.

2.1.3.4.2 Closure-in-Place

As described in Table 2.1-3 Closure-in-Place was identified as the preferred closure method for Ash Impoundment 2 and the former SWL. Closure-in-Place involves stabilizing the CCR in place and installing a cover system. As described in the PEIS, there are three Closure-in-Place methods (A) re-grading the impoundment inward within the existing dikes; (B) reducing the footprint by consolidating materials into a portion of the existing impoundment; and (C) reconfiguring and supplementing the impoundment with borrow material.

Primary actions common to all methods of Closure-in-Place were identified in the PEIS. Table 2.1-4 summarizes these actions and demonstrates the consistency and applicability of the closure alternatives for the impoundments at SHF with the constraints of the analyses performed as part of the PEIS.

Table 2.1-4. Primary Actions Associated with Closure-in-Place of Ash Impoundments

Closure Activity	Programmatic Impoundment Closure Activity	Proposed SHF Impoundment Closure Activity
Ensure Berm Stability	For impoundments that are Closed-in-Place, TVA will make appropriate investigations and/or modifications to ensure that the berm stability is at a level that meets or exceeds industry acceptable factors of safety using conservative assumptions. The proposed closure grades of the facilities will be evaluated prior to construction, and any needed improvements to the berms will be made as part of the closure system construction.	TVA has evaluated the structural stability at the surface impoundments at SHF per requirements of the CCR Rule and as part of the development of conceptual closure plans. All berms meet all appropriate static and seismic stability safety factors.

Table 2.1-4. Primary Actions Associated with Closure-in-Place of Ash Impoundments

Closure Activity	Programmatic Impoundment Closure Activity	Proposed SHF Impoundment Closure Activity
Consider Opportunities for Beneficial Use of Ash	Beneficial reuse is considered by TVA as part of all ash management activities. Such reuse may include incorporation of ash from CCR impoundments as part of the impermeable cover system.	TVA pursues beneficial reuse whenever feasible. With the installation of the dry scrubbers at SHF, the plant will no longer produce fly ash as a discrete stream. The fly ash is captured in the baghouse with the dry scrubber product, resulting in one blended material. There is currently no commercial beneficial use for dry scrubber material containing fly ash. Beneficial reuse of bottom ash requires it to be free of mill rejects. The current configuration at SHF does not allow for segregation and would require installation of a separate handling system for the mill rejects. TVA is initiating studies to determine the feasibility of installing systems to handle mill rejects separate from bottom ash. Lining and reuse of the ash impoundments at SHF include grading and reconfiguring of CCR to consolidate CCR, reduce footprint, and promote site drainage prior to cover system placement. Closure of any portions of the impoundments or SWF at SHF will reuse CCR from adjacent areas to develop design grades to support the final cover system.
Lower Ash Impoundment Water Level	Dewatering will be undertaken in a manner to comply with conditions of existing National Pollution Discharge Elimination System permits or TVA will work with appropriate federal/state agency to obtain necessary approvals	Dewatering of impoundments at SHF will comply with KPDES permit requirements.
Identify Temporary Laydown Areas and Borrow Areas	TVA anticipates temporarily using approximately 5 to 10 acres per site for vehicle and equipment parking, materials storage, and construction administration.	Borrow is anticipated to be obtained from the Shawnee East Site.

Table 2.1-4. Primary Actions Associated with Closure-in-Place of Ash Impoundments

Closure Activity	Programmatic Impoundment Closure Activity	Proposed SHF Impoundment Closure Activity
Grade to Consolidate CCR, Reduce Footprint and Promote Site Drainage	CCR layer is stabilized such that it is structurally suitable as a base layer. This stabilization could include dewatering, addition of amendments (e.g., Portland cement), and/or compaction. Dewatering activities could include decanting or drawdown (which is the removal of free or ponded liquid from an impoundment and must meet current permit limits) up to the removal of water in the pore spaces of the impoundment. These activities could require additional monitoring or meeting additional limits from state regulators. TVA will try to optimize the use of existing CCR material to achieve final grade (see options below). Fill/borrow material would be used to supplement CCR material and contoured to provide adequate storm water management.	Closure of the ash impoundments at SHF includes grading and reconfiguring CCR to consolidate CCR, reduce footprint, and promote site drainage prior to cover system placement.
Install Cover System	TVA will install a cover system which either meets or exceeds CCR Rule cover system performance standards or state cover system requirements. Storm water management infrastructure will maintain positive drainage. The cover system must control, minimize, or eliminate to the maximum extent practicable, post-closure infiltration of liquids into the CCR and releases of CCR, CCR constituents, or CCR contact run-off to groundwater or surface waters.	Closure of Ash Impoundment 2 and the former SWL includes the use of composite geosynthetic protective cover system that meets or exceeds the CCR Rule performance standard or state promulgated standard.
Install or Expand Groundwater Monitoring System	A groundwater monitoring system will be installed to ensure that an adequately robust system is in place that meets or exceeds federal or state requirements. States may require groundwater monitoring, assessment, and if appropriate, corrective action.	TVA would install and operate a groundwater monitoring system per EPA CCR rule requirements at all closed impoundments and multiunits, as is the case with SHF.
Closure Documentation	Prepare documentation to demonstrate that appropriate closure activities were successfully implemented	Preliminary closure plans have been prepared for all of the impoundments at SHF. Closure plans will be finalized upon successful completion of the NEPA review.
Post Closure Care	Long-term operations and maintenance activities (e.g., maintaining the cover system, monitoring, and reporting) are implemented, as necessary.	Post closure plans will be finalized upon successful completion of the NEPA review.

2.1.4 Impoundment Closure Alternatives Retained for Detailed Analysis

2.1.4.1 Existing Former SWL and Ash Impoundment 2 Closure

As described above, after TVA's evaluation of the alternatives for closure of the former SWL and Ash Impoundment 2, the preferred alternative for this part of the action consists of Closure-in-Place and consolidation of the former SWL and Ash Impoundment 2 including:

- Removing the ash in the northwest corner of Ash Impoundment 2;
- Placing the removed ash from the northwest corner of Ash Impoundment 2 in the consolidated Ash Impoundment 2/former SWL area (Figure 2.2-1);
- Covering the consolidated Ash Impoundment 2 and former SWL with a geomembrane cap system;
- Constructing a new perimeter dike along the northern boundary of the former SWL;
- Removing the remaining Ash Impoundment 2 dikes and support structures on the north side;
- Construction of Process Water Basin(s) to receive wet ash once Ash Impoundment 2 is separated from the SHF facility and the dewatering system is constructed; and
- Utilizing temporary laydown yards/staging areas.

2.2 Project Alternatives Retained for Detailed Analysis

Based on the above analysis and screening criteria, TVA has determined that there are three NEPA alternatives available to TVA: (A) No Action; (B) Construction of an onsite CCR Landfill and Closure-in-Place by reduced footprint of the former SWL and Ash Impoundment 2; or (C) Offsite disposal of dry CCR and Closure in-Place by reduced footprint of the former SWL and Ash Impoundment 2.

2.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and not cease operations at its former SWL and Ash Impoundment 2 (i.e., neither facility would be closed). Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF, or haul CCR to an existing offsite permitted landfill. No closure activities (i.e., cover system construction) would occur under the No Action Alternative. The impoundments would continue to receive the storm water and other process wastewaters that they currently receive. TVA would continue safety inspections of berms to maintain stability and all impoundments would be subject to continued care and maintenance activities.

TVA would continue to dispose of wet bottom ash in onsite impoundments until completion of the dewatering facility. The existing associated impoundments would continue to be operated as currently permitted as long as storage capacity is available. Since there is limited capacity for additional CCR disposal onsite, at some point in the future, capacity to store CCR onsite will become a limiting factor for continued SHF operations. TVA's 2015 Integrated Resource Plan

(TVA 2015c) identifies SHF as a facility that will continue to operate as part of its balanced portfolio of energy resources in the near term. However, SHF cannot continue to operate if it is not compliant with the CCR Rule. Under the No Action Alternative, SHF's operations would not comply with the CCR Rule, therefore, this alternative would not meet the Purpose and Need for the proposed action and is not considered viable or reasonable. It does, however, provide a benchmark for comparing the environmental impacts of implementation of Action Alternatives B and C.

2.2.2 Alternative B – Construction and Operation of an Onsite Landfill and Closure-in-Place of the Former Special Waste Landfill and Ash Impoundment 2

Under Alternative B, TVA would undertake a series of actions to manage CCR produced at SHF (Figure 2.2-1). These actions include:

- Construction of Process Water Basin(s) to receive plant flows and allow for operations to cease at Ash Impoundment 2 once the dewatering system is constructed (Figure 2.2-1). The proposed Process Water Basin(s) would be comprised of one or two, approximately 10-acre lined cells that will receive general plant process flows, Bottom Ash Transport Water effluent from the Bottom Ash Dewatering Facility, and storm water runoff from the Coal Yard Storage Area and Plant Powerhouse. The Process Water Basin(s) would treat these wastewater streams before discharging through the KPDES permitted Outfall 001 to the Ohio River.
- Cease operations in Ash Impoundment 2.
- Remove portions of the ash in Ash Impoundment 2 to allow for construction of a new perimeter dike along the northern boundary of the dredge cell and adjacent former SWL.
- Remove and consolidate the remaining ash in the northwest corner of Ash Impoundment 2.
-
- Extract borrow materials from the Shawnee East Site and place this soil on the former SWL and Ash Impoundment 2 (including the dredge cell) as part of the closure cap system.
- Cover the former SWL and remaining Ash Impoundment 2 (including the dredge cell) with a geomembrane cap system.
- Remove the remaining Ash Impoundment 2 dikes and support structures on the north side of the impoundment.
- Utilize temporary laydown yards/storage areas as needed.
- Construction and operation of a new CCR Landfill onsite at Shawnee East Site.
- Upgrading of the existing gravel access road to a paved haul road.

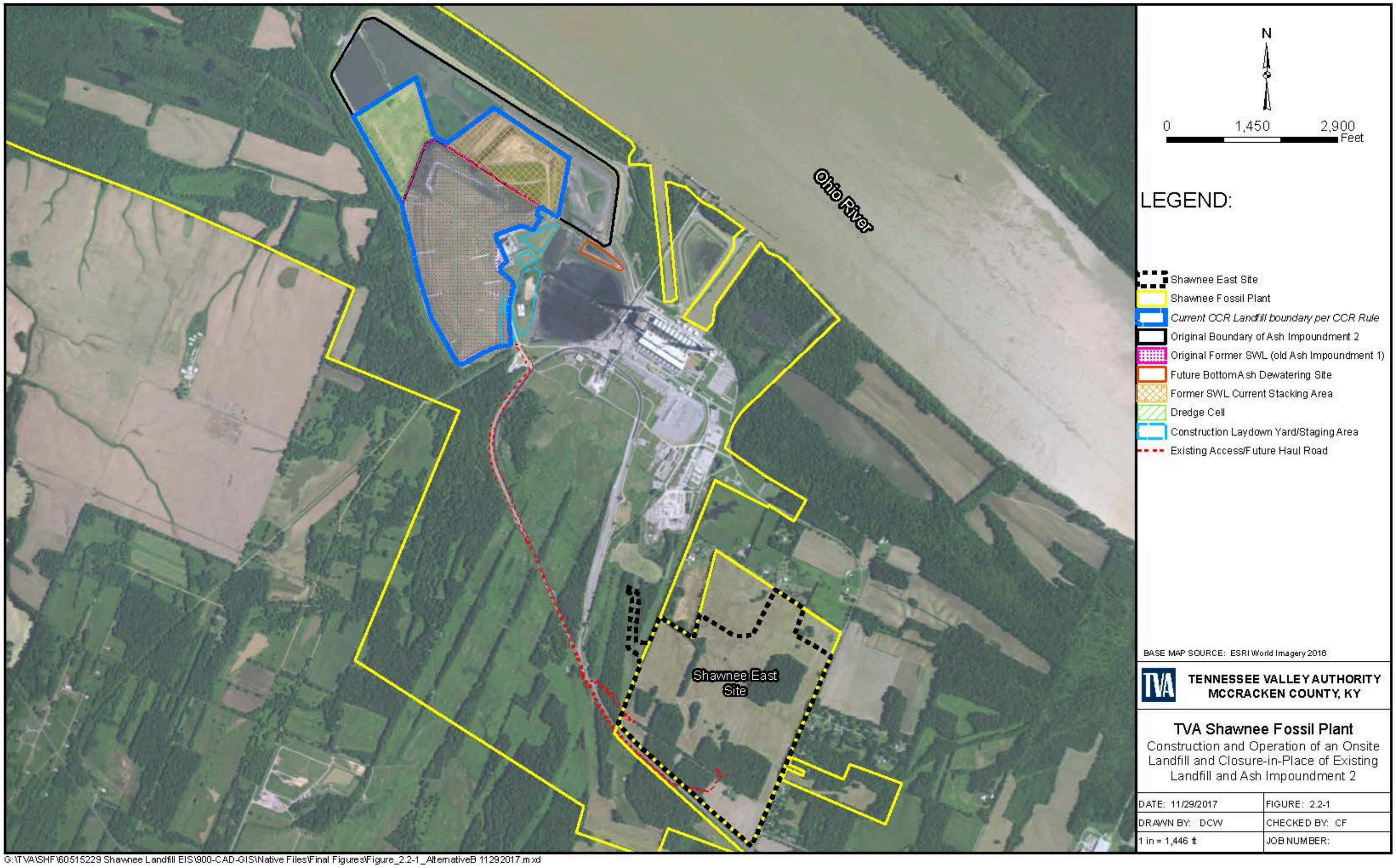


Figure 2.2-1. Alternative B Construction and Operation of a CCR Landfill at the Shawnee East Site and Closure-in-Place of the Former SWL and Ash Impoundment 2

2.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Most activities would be the same under Alternative C as described previously for Alternative B. However, under Alternative C, the new CCR Landfill would not be constructed; rather, future CCR would be transported to the Freedom Waste Landfill for disposal. The actions under Alternative C include:

- Ash Impoundment 2 and former SWL Closure-in-Place as described for Alternative B (Figure 2.2-1).
- Construction of Process Water Basin(s).
- Excavation of borrow material from the approximately 205-acre Shawnee East Site for use as cover material for the closure activities. The site would only be used for excavation of borrow material and then revegetated following completion of closure of Ash Impoundment 2 and the former SWL (no landfill would be constructed). Final topography of the site would be determined after completion of closure activities.
- Upgrading of the existing gravel access road to a paved haul road.
- Hauling CCR produced at SHF to an offsite, permitted landfill.

2.3 Summary of Alternative Impacts

The environmental impacts of Alternatives A, B, and C are analyzed in detail in Chapter 3 and are summarized in Table 2.3-1. These summaries are derived from the information and analyses provided in the Affected Environment and Environmental Consequences sections of each resource in Chapter 3.

Table 2.3-1. Summary and Comparison of Alternatives by Resource Area

Resource	Alternative A – No Action	Alternative B – Construction of Onsite Landfill and Closure of Former SWL and Ash Impoundment 2	Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of Former SWL and Ash Impoundment 2
Air Quality	No impact associated with Former SWL operations. Inability to store CCR would require SHF to reduce operations which would theoretically result in decreased emissions in the local area.	Temporary minor impacts during closure and during the construction of the new CCR landfill. Minor impacts during operation of the new CCR landfill. Minor cumulative effects.	Temporary minor impacts during closure. Minor long-term impacts associated with transportation of CCR to the offsite landfill. Minor cumulative effects.

Table 2.3-1. Summary and Comparison of Alternatives by Resource Area

Resource	Alternative A – No Action	Alternative B – Construction of Onsite Landfill and Closure of Former SWL and Ash Impoundment 2	Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of Former SWL and Ash Impoundment 2
Climate Change and Greenhouse Gases	No impact associated with Former SWL operations. Long-term impacts to plant operations due to inability to store CCR would theoretically result in decreased GHG emissions.	No impacts during closure or construction. No impacts during operation of the CCR Landfill. No cumulative effects.	No impacts during closure or the construction of the landfill. Minor impacts during operations associated with transport to the offsite landfill. No cumulative effects.
Land Use	No impact.	Minor impacts associated with closure activities. Minor impacts due to the conversion of land use from agricultural to industrial at the CCR Landfill. No cumulative effects.	Minor impacts associated with closure activities. Minor impacts due to the conversion of land use from agricultural to industrial due to clearing of borrow area at the Shawnee East Site. No cumulative effects.
Prime Farmland	No impact.	Minor impacts due to the loss of approximately 198 acres of prime farmland and farmland of statewide importance for the CCR Landfill. Minor cumulative effects.	Minor impacts due to the loss of approximately 198 acres of prime farmland and farmland of statewide importance for borrow at the CCR Landfill site. Minor cumulative effects.
Geology and Seismology	No impact.	Minor impacts related to the removal of soils at the CCR Landfill, minor geology impacts in a regional context, and minor potential seismic impacts. Minor cumulative effects.	Substantial impacts related to the removal of soils for borrow at the CCR Landfill, minor geology impacts in a regional context, and minor potential seismic impacts (slightly less than Alternative B). Minor cumulative effects.
Groundwater	No impact.	Minor temporary impacts during construction. Minor beneficial permanent impacts due to reduction of potential for CCR constituents to move into groundwater after closure. Minor impacts during CCR landfill operations. Minor cumulative effects.	Minor temporary impacts during construction. Minor beneficial permanent impacts due to reduction of potential for CCR constituents to move into groundwater after closure. Minor impacts during offsite landfill operations. Minor cumulative effects.

Table 2.3-1. Summary and Comparison of Alternatives by Resource Area

Resource	Alternative A – No Action	Alternative B – Construction of Onsite Landfill and Closure of Former SWL and Ash Impoundment 2	Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of Former SWL and Ash Impoundment 2
Surface Water	No impact.	Minor impacts associated with alterations of storm water flow, construction related storm water runoff, and leachate at the CCR Landfill. Potential impacts of discharging storm water from the landfill directly to Unnamed Tributary of Little Bayou Creek would be mitigated as needed to ensure compliance with Clean Water Act. Minor cumulative effects.	Minor impacts associated with alterations of storm water flow and construction related storm water runoff. Minor cumulative effects.
Floodplains	No impact.	No impact. No cumulative effects.	No impact. No cumulative effects.
Vegetation	No impact.	Minor impacts due to changes in species composition during closure, clearing, construction and operation of the new landfill; revegetation post-closure. Minor cumulative effects.	Minor impacts due to changes in species composition during closure, clearing of borrow areas, revegetation post-closure (less than Alternative B). Minor cumulative effects.
Wildlife	No impact.	Minor impacts due to habitat changes at the ash impoundment and both landfill locations. Minor cumulative effects.	Minor impacts at the ash impoundment and former SWL locations (less than Alternative B). Minor cumulative effects.
Aquatic Ecology	No impact.	Minor impacts. No cumulative effects.	Minor impacts. No cumulative effects.
Threatened and Endangered Species	No impact.	With mitigation for bat habitat, no significant impacts to federally listed species. Potential minor impacts to state status species. Minor cumulative effects.	With mitigation for bat habitat, no significant impacts to federally listed species. Potential minor impacts to state status species. Minor cumulative effects.
Wetlands	No impact.	Minor impacts. No cumulative effects.	Minor impacts. No cumulative effects.
Socioeconomics and Environmental Justice	No impact.	Negligible beneficial impacts on demographics, economics, and employment. No adverse impacts on communities and environmental justice. No cumulative effects.	Negligible beneficial impacts on demographics, economics, and employment. No adverse impacts on communities and environmental justice. No cumulative effects.

Table 2.3-1. Summary and Comparison of Alternatives by Resource Area

Resource	Alternative A – No Action	Alternative B – Construction of Onsite Landfill and Closure of Former SWL and Ash Impoundment 2	Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of Former SWL and Ash Impoundment 2
Natural Areas, Parks, and Recreation	No impact.	Minor temporary impacts during construction. Minor permanent impacts during operations at the new landfill. Minor cumulative effects.	Minor temporary impacts during construction (less than Alternative B). Minor cumulative effects.
Transportation	No impact.	Minor temporary impacts during construction. Minor cumulative effects.	Minor temporary impacts during construction activities. Moderate impacts during operation activities due to hauling CCR to offsite landfill (approximately 190 to 350 trucks per day). Moderate cumulative effects.
Visual Resources	No impact.	Minor temporary impact during construction. Moderate impact during operation of the new landfill in some locations. No cumulative effects.	Minor temporary impact during construction. No cumulative effects.
Cultural and Historic Resources	No impact.	With mitigation, minor impact during construction of the new landfill. No cumulative effects.	With mitigation, minor impact during removal of borrow material. No cumulative effects.
Noise	No impact.	No impact during closure activities. Minor impact during construction. Minor to moderate during operation of the CCR Landfill. No cumulative effects.	No impact during closure. Minor impact during excavation of borrow material. Minor impact due to CCR transport. Minor cumulative effects.
Solid Waste and Hazardous Materials	No impact.	Minor temporary impact during closure and construction activities. No impacts to the amount of waste generated, minor impacts at the new CCR landfill. Minor cumulative effects.	Minor temporary impact during closure activities. No impacts to the amount of waste generated, significant impacts at the former SWL during operations. Minor cumulative effects.
Public Health and Safety	No impact.	With use of BMPs, no impacts during closure, construction, or operation activities. No cumulative effects.	With use of BMPs, no impacts during closure or borrow activities. Minor impacts during transportation of CCR. No cumulative effects.

2.4 Identification of Mitigation Measures and Best Management Practices

TVA's analysis includes mitigation, as required, to reduce or avoid adverse effects. Mitigation measures identified in Chapter 3 to avoid, minimize, or reduce adverse impacts to the environment and project specific BMPs are summarized below.

Mitigation Measures include:

- Due to the loss of potentially suitable foraging and roosting habitat for endangered bat species, Section 7 consultation with the United States Fish and Wildlife Service (USFWS) would be required. Any tree removal would be scheduled so that all tree clearing would be conducted between October 15 and March 31, outside of the bat's breeding season.
- Actions involving wetlands and/or stream crossings and stream alterations would be subject to requirements outlined in the federal Clean Water Act Section 404. An approved jurisdictional determination by the USACE determined that only a 0.7-acre wetland on the Shawnee East Site would require a Section 404 permit for impacts that could occur in conjunction with clearing, excavating, or grading during landfill construction. Where impacts to wetlands cannot be avoided, the Section 404 permitting program would require mitigation to offset impacts, and these mitigation measures would be clarified at the end of consultation with the USACE. TVA would obtain and adhere to all conditions stipulated in the permit.
- To minimize visual and noise impacts, TVA would plant and maintain a vegetative buffer around the proposed CCR Landfill as a natural screen.
- TVA would avoid the National Register of Historic Places (NRHP)-eligible sites in the vicinity of the Shawnee East Site.

Best Management Practices include:

- TVA would continue regulatory groundwater and surface water testing in compliance with existing regulations and permits. TVA would implement measures such as water quality monitoring, assessment, and corrective action programs as mandated by state requirements and the CCR rule.
- Any discharges during construction and operation activities would comply with KPDES limits and Kentucky Water Quality Standards to ensure in-stream water quality. The leachate would be treated as required to meet all applicable KPDES permit requirements and in-stream water quality standards. TVA would conduct a characterization of the liquids coming from CCR constituents and runoff streams to confirm no significant impacts to the Ohio River or the Unnamed Tributary to Little Bayou Creek. The discharge waters would be analyzed for metals and other parameters. If determined to be necessary, appropriate mitigation measures, which could include the rerouting of this waste stream to either the proposed Process Water Basin(s) or directly to the Ohio River, would be evaluated and implemented to ensure that the discharge limits in the KPDES permit are met.

- If construction or operations have the potential to emit pollutants greater than acceptable thresholds in SHF's existing Title V permit, a request to modify the permit would be required for the prevention of significant deterioration of air quality.
- Fugitive dust emissions would be controlled by wet suppression and other appropriate BMPs in accordance with the SHF Title V permit.
- TVA requires all contractors to keep construction equipment properly maintained and to use BMPs (such as covered loads and wet suppression) to minimize dust, if necessary.
- The Site BMP Plan, required by the KPDES permit, would be updated to include project-specific BMPs or a stand-alone project BMP plan would be prepared. This plan would identify specific BMPs to address construction-related activities that would be adopted to minimize storm water impacts. During construction, TVA would utilize a Storm Water Pollution Prevention Plan (SWPPP) and storm water flows would be properly treated with either implementation of proper BMPs or by diverting the storm water discharges to an appropriate storm water outfall or impoundment for co-treatment.
- Equipment washing and dust control discharges would be handled in accordance with BMPs described in the BMP Plan required by the site's KPDES Permit KY0004219 to minimize construction impacts to surface waters.
- Onsite hydrostatic testing will have the option to use potable or surface waters and would be covered under the current KPDES Permit KY0004219.
- Use of native and/or non-invasive species would promote the rapid establishment of desirable vegetation and minimize invasive plant impacts.
- TVA would manage all solid waste and hazardous wastes generated from construction activities in accordance with standard procedures for spill prevention and cleanup along with waste management protocols in accordance with pertinent federal, state, and local requirements.
- Construction debris and wastes would be managed in accordance with federal, state, and local requirements.
- TVA would employ training and job safety plans to ensure employee safety.

2.5 Preferred Alternative

TVA has identified Alternative B – Construction of Onsite Landfill, Closure-in-Place by reduced footprint of Ash Impoundment 2, and Closure-in-Place of former SWL as the preferred alternative. Alternative B would achieve the purpose and need of the project and avoid offsite transfer of CCR along public roads thus eliminating the long-term impacts associated with air emissions, increased traffic and associated safety risks, and disruptions to the public that would be associated with such offsite transport.

CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the baseline environmental conditions (affected environment) of environmental resources in the project area and the anticipated environmental consequences that would occur from implementation of the alternatives identified for further study as described in Chapter 2. TVA considered all environmental factors potentially influenced by the proposed project as part of this analysis.

3.1 Air Quality

3.1.1 Affected Environment

Congress mandated the protection and enhancement of our nation's air quality resources through passage of the Clean Air Act which regulates the emission of air pollutants. The EPA in its implementing regulations established National Ambient Air Quality Standards (NAAQS) for several "criteria" pollutants that are designed to protect the public health and welfare with an ample margin of safety. The criteria pollutants are ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead.

There are two types of NAAQS: primary standards (set to protect public health) and secondary standards (set to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings). Specified geographic areas are designated as attainment, nonattainment or unclassifiable for specific NAAQS. Areas with ambient concentrations of criteria pollutants exceeding the NAAQS are designated as nonattainment areas, and new emissions sources to be located in or near these areas are subject to more stringent air permitting requirements.

Air quality in McCracken County meets applicable federal and state air quality standards. McCracken County and the adjacent counties in Kentucky (Ballard, Marshall, Carlisle, and Livingston) are all in attainment with applicable NAAQS (EPA 2016a) and Kentucky's ambient air quality standards. Adjacent counties in Illinois (Massac and Pulaski) are also in attainment with applicable NAAQS (EPA 2016a) and Illinois' ambient air quality standards.

The TVA region, in general, faces current challenges in maintaining air quality with respect to ozone and particulate matter. Regional haze also affects visibility in the area. Changes in climate can affect each of these pollutants, but in different ways. Ozone concentrations can be expected to increase with temperature increases. During hot and dry periods, particulate matter concentrations could be affected by soil drying, which would both increase the risk of wildfires and allow dust to become airborne more readily. Increases in wildfires could also lead to increased releases of background mercury to the air. Air quality is dependent on many meteorological variables and there is significant uncertainty in future temperature and precipitation patterns. Regional variations in pollutants and climate can affect site-specific areas like SHF. Section 3.2 discusses climate related effects in further detail.

SHF holds an operating permit issued under Title V of the Clean Air Act. The proposed CCR Landfill facility would be subject to local, state and federal approvals and regulations. These regulations impose permitting requirements and specific standards for expected air emissions.

3.1.2 Environmental Consequences

3.1.2.1 Alternative A – No Action Alternative

Under the No Action Alternative, TVA would continue current plant operations and would not cease operations at its former SWL and Ash Impoundment 2 or close either of those facilities. Operation and maintenance activities would continue to generate small amounts of emissions from equipment and vehicles used in operation and maintenance of the ash impoundments. Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF, or haul CCR to an existing permitted landfill. Rather, CCRs would continue to be stored in Ash Impoundment 2 and the former SWL. BMPs are employed to reduce emissions from this landfill; therefore, there is no current impact to air quality associated with the former SWL operations. In the long term, however, once capacity to manage CCR produced at SHF is exceeded, plant operations would either have to be suspended, or an alternate storage solution would need to be determined, as there would be no option for storage of CCR produced at SHF. Because SHF provides base-load power for a large portion of TVA's service territory, stopping operations at SHF is not consistent with TVA's mission or its 2015 Integrated Resource Plan. Continuing current operations would not comply with the CCR Rule therefore the No Action Alternative is not consistent with this proposed project's purpose and need.

3.1.2.2 Alternative B – Construction of Onsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

3.1.2.2.1 Construction

Air pollutant emissions would be generated during the construction phase for all three components of the project. Construction activities would be temporary, up to 5 years for the closure of the former SWL and Ash Impoundment 2. It is anticipated the new CCR landfill would be completed prior to completion of closure activities.

In the State of Kentucky, facilities holding a Title V permit are required to modify that permit for construction activities. TVA has analyzed Title V permit requirements and would coordinate with the State of Kentucky for a Title V modification in association with the proposed closure activities and construction of the new CCR landfill.

Combustion of gasoline and diesel fuels by internal combustion engines (vehicles, generators, construction equipment, etc.) during closure of facilities and construction of the proposed CCR Landfill would generate local emissions of particulate matter, nitrogen oxides, carbon monoxide, volatile organic compounds, and sulfur dioxide during the site preparation and construction period. Construction activities would also generate fugitive dust. All construction activities would be carried out on SHF property and no offsite activities are anticipated. Kentucky regulations prohibit the discharge of visible fugitive dust emissions beyond the lot line of the property on which the emissions originate (KAR 2016). Accordingly, applicable control and suppression measures as well as BMPs to minimize emissions are in place under the fugitive dust control plan in SHF's Title V permit.

Construction equipment expected to be required for the new CCR landfill construction includes:

- 2 large excavators
- 3 large bulldozers
- 5 articulated haul trucks
- 1 water truck
- 1 loader
- 5 pickup trucks
- 3 all-terrain vehicles
- Semi-trailers or other trucks making periodic deliveries

Similar types and numbers of equipment would be utilized for the closure of Ash Impoundment 2 and the former SWL. It is estimated that approximately 1.5 million cubic yards of CCR would be moved from one portion of Ash Impoundment 2 to an adjacent area as part of the closure-in-place by reduced footprint process. Additionally, as part of the Ash Impoundment 2 and former SWL closure process, borrow material would be transported from the Shawnee East Site for use as a soil cap during the closure of Ash Impoundment 2 and the former SWL. The transport of material for both the consolidation of Ash Impoundment 2 and the movement of borrow material would occur over the course of several years, therefore the small incremental increase in daily emissions would not constitute a significant increase in the amount of air emissions at SHF.

All equipment would be used onsite and any air quality impacts would be limited to the immediate site area. Emissions associated with the combustion of gas and diesel fuels by internal combustion engines would generate local emissions of particulate matter, nitrous oxides, carbon monoxide, volatile organic compounds, and sulfur dioxide during the construction period. Direct and indirect air quality impacts from construction activities would be temporary (lasting no longer than 5 years), and would depend on both man-made factors (intensity of activity, control measures, etc.) and natural factors such as wind speed and direction, soil moisture and other factors. However, even under unusually adverse conditions, these emissions would have, at most, a minor transient impact on offsite air quality and would be well below the applicable ambient air quality standard. Given the relatively low number and types of equipment that would be used for the construction activities, and the intermittent nature of construction, overall, the potential impacts to air quality from construction-related activities for the project would be temporary and minor.

3.1.2.2.2 Operation

Once construction is completed, there would be no air emissions associated with the closed former SWL and Ash Impoundment 2 as they would cease active operations. Air impacts related to general maintenance such as mowing and drainage clearance would be negligible. Therefore, no air quality impacts would be associated with these facilities following closure.

Operation of the proposed CCR Landfill would generate air emissions associated with vehicle emissions caused by onsite handling of CCR and transportation of CCR to the proposed CCR Landfill. CCR handling, transport, and placement activities would utilize methods similar to current operations at the former SWL. Vehicles emitting air pollutants would include both trucks transporting the CCR to the new landfill, as well as earth-moving equipment managing and covering the ash material once it is in the landfill. TVA estimates SHF would produce approximately 9,400 to 17,500 cubic yards of CCR per week. This would result in a total of 190 to 350 truck trips per day, approximately 3 miles roundtrip, to transport CCR from SHF to the proposed CCR Landfill based on a typical 5-day work week. The total amount of air emissions associated with this vehicular traffic would be minor in comparison to traffic in the region and would not adversely affect local air quality.

Operation of the new landfill would be subject to specific state and federal process regulations and fugitive dust regulations. The proposed facility would be operated in compliance with state and federal regulations. Kentucky regulations prohibit the discharge of visible fugitive dust emissions beyond the lot line of the property on which the emissions originate (KAR 2016). To minimize fugitive dust from landfill operations, CCR would be moisture-conditioned and transported to the working face of the landfill using heavy-dump trucks over the access/haul road within the plant boundary. Once placed, the CCR material would be spread and compacted. Other measures to control dust inside the limits of the proposed landfill would include mulch, wind breaks/barriers, tillage, and stones as permitted by an approved air permit. At the end of each day's activities, the surface of the landfill would be sealed as practicable with a smooth drum roller. As areas of the landfill reach their capacity, they would be covered by an approved system.

The landfill's electricity requirements can be met using plant power or local power along Steam Plant Road or Metropolis Lake Road; therefore, there would be no new air emissions associated with new generation.

Overall, direct and indirect air emissions associated with operations of the proposed CCR Landfill would be minor. Emissions from the landfill would have, at most, a minor transient impact on offsite air quality and would be well below the applicable ambient air quality standards. Therefore, potential air quality impacts associated with Alternative B would be minor.

3.1.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

3.1.2.3.1 Construction

Air emissions associated with closure of Ash Impoundment 2 and the former SWL would be substantially the same under Alternative C as under Alternative B. The Shawnee East Site would be used for borrow material for the closure of the Ash Impoundment 2 and the former SWL. The impacts of excavating this borrow material and transporting it to the closure area would also be similar to the impacts evaluated under Alternative B Construction. Under this alternative, TVA would not construct and operate the proposed CCR Landfill at SHF. Instead, future CCR would be hauled to an offsite landfill approximately 30 miles away. Thus there are no emissions associated with construction of a new landfill under this alternative. Therefore, impacts associated with construction would be smaller under Alternative C than Alternative B.

3.1.2.3.2 Operation

The former SWL and Ash Impoundment 2 facilities would close; therefore, no air emissions or air quality impacts would be associated with their operation.

Future CCR material would be hauled to an offsite landfill approximately 30 miles away. As described in Section 3.1.2.2, TVA estimates SHF would produce approximately 9,400 to 17,500 cubic yards of CCR per week. This would result in a total of 190 to 350 truck trips per day to transport CCR from SHF based on a typical 5-day work week. Because of the distance, air quality impacts associated with the vehicle miles traveled would be significantly greater than for Alternative B. However, the total amount of these emissions would be small in comparison to the aggregate existing emissions along the same route from other traffic in the region. Therefore, direct and indirect emissions impacts to air quality in the region would be minor and exceedances of applicable ambient air quality standards are not expected. It is anticipated that all trucks used to transport CCR would be maintained in good working condition with current emission control technologies that would minimize local air quality impacts.

Emissions associated with Alternative C would not result in an exceedance of applicable ambient air quality standards. However, emissions from the additional vehicles required to transport CCR to the offsite landfill and to manage placement of the CCR at the landfill are expected to result in long-term effects that would be greater than those evident under Alternative B, but would still be considered minor.

3.2 Climate Change and Greenhouse Gases

3.2.1 Affected Environment

The 2014 National Climate Assessment concluded that the global climate is projected to continue to change over this century and beyond. Average temperature in the United States has increased by 1.3 degrees Fahrenheit (°F) to 1.9°F since 1895, and most of this increase has occurred since 1970. The most recent decade has been reported as the nation’s warmest on record. Temperatures are projected to rise another 2°F to 4°F in most areas of the United States over the next few decades. The amount of warming projected beyond the next few decades is directly linked to the cumulative global emissions of heat-trapping greenhouse gases (GHGs) and particles. By the end of this century, a roughly 3°F to 5°F rise is projected under a lower GHG emissions scenario, and a 5°F to 10°F rise is projected for a higher GHG emissions scenario. In both projections, emissions are predominantly from fossil fuel combustion (Melillo et. al. 2014).

3.2.1.1 Southeastern United States

The southeastern United States, including the State of Kentucky, is one of the few regions globally that has not exhibited an overall warming trend in surface temperature over the 20th century. The region warmed during the early part of last century, cooled for a few decades, and is now warming again. The lack of an overall upward trend over the entire period of 1900-2012 is unusual compared to the rest of the United States and other parts of the world. This feature has been dubbed the "warming hole" and has been the subject of considerable research, although a conclusive cause has not been identified (Kunkel et al. 2013). From 1970 to the present, temperatures have increased by an average of 2°F, with higher average temperatures during summer months. There have been increasing numbers of days above 95°F and nights above 75°F, and decreasing numbers of extremely cold days since 1970.

Increasing temperatures and the associated increase in frequency, intensity, and duration of extreme heat events will affect public health, natural and man-made environments, energy, agriculture, and forestry. Higher temperatures also contribute to the formation of harmful air pollutants and allergens. Ground-level ozone, an air pollutant which generally increases with rising temperatures, is projected to increase in the 19 largest urban areas of the Southeast, leading to an increase in deaths. Heat stress also adversely affects dairy and livestock production, and is projected to reduce crop productivity, especially when coupled with increased drought (Melillo et. al. 2014).

In the last three decades, the percentage of the Southeast region experiencing moderate to severe drought increased, according to the Palmer Drought Severity Index (EPA 2010). Drought conditions can negatively affect agriculture, water supplies, energy production, and many other aspects of society. Lower streamflow and groundwater levels can also harm plants and animals, and dried-out vegetation increases the risk of wildfires. The primary cause of droughts is an extended period of deficient precipitation. The intensity of droughts can be exacerbated by increased rates of evaporation (due to high temperatures), high winds, lack of cloud cover, and/or low humidity (EPA 2016b).

The southeastern United States leads the nation in the number of wildfires, averaging 45,000 fires per year, and this number continues to increase. Increasing temperatures contribute to increased fire frequency, intensity, and size (Melillo et. al. 2014). The Southeast region experiences a wide range of extreme weather and climate events that affect human society, ecosystems, and infrastructure. Since 1980, the Southeast has experienced more billion-dollar weather disasters than any other region in the United States. Climatic phenomena that have major impacts on the Southeast include: heavy rainfall and floods, extreme heat and cold, winter storms (in northern regions), severe thunderstorms and tornadoes, and tropical cyclones (Kunkel et al. 2013).

Between 2006 and 2050, average annual temperatures in Kentucky are expected to increase between 3.6 and 5.1°F, depending on various emissions scenarios that assume different values for global population, technology, energy, land use, economy, and agriculture. The trend of increasing drought and flood events are predicted to continue.

3.2.1.2 Greenhouse Gases

Similar to the glass in a greenhouse, certain gases in the atmosphere absorb heat that is radiated from the surface of the Earth and that would otherwise have escaped the atmosphere. These gases are primarily carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perflurocarbons (PFCs), sulfur hexafluoride (SF_6), and hydroflurocarbons (HFCs). Increases in the atmospheric concentrations of these gases can cause the Earth to warm by trapping more heat. This is commonly referred to as the “Greenhouse effect” and these gases are typically referred to as GHGs.

In nature, CO_2 is exchanged continually between the atmosphere, plants, and animals through processes of photosynthesis, respiration, and decomposition, and between the atmosphere and oceans through gas exchange. Billions of tons of carbon in the form of CO_2 are annually absorbed by oceans and living biomass (also known as “sinks”) and are annually emitted to the atmosphere through natural and man-made processes (also called “sources”). When in equilibrium, carbon fluxes among these various global reservoirs are roughly balanced.

The most abundant man-made GHG is CO_2. The major anthropogenic emissions sources of CO_2 in the United States include combustion of fossil fuels (such as coal); noncombustion of fossil fuels in producing chemical feedstocks, solvents, lubricants, waxes, asphalt, and other materials; iron and steel production; cement production; and natural gas extraction and transportation systems. The major U.S. emission sources of methane are ruminant animals (cows and sheep), landfills, natural gas extraction and transportation systems, and coal mining. HFCs, PFCs, and SF_6 are all industrial chemicals emitted by various industrial activities, there are no natural sources of these GHGs (Intergovernmental Panel on Climate Change 2013). GHGs are present in the atmosphere naturally, released by natural sources, or formed from secondary reactions taking place in the atmosphere. In the last 200 years, substantial quantities of GHGs have been released into the atmosphere by human activities. These extra emissions are increasing GHG concentrations in the atmosphere, enhancing the natural greenhouse effect, which is considered to be causing or contributing to global warming (Intergovernmental Panel on Climate Change 2013).

Coal- and gas-fired electric power plants and automobiles are major sources of CO_2 in the United States. In 2014, worldwide man-made annual CO_2 emissions were estimated at 36 billion tons, with sources within the United States responsible for 14 percent of this total (Le Quéré et al. 2013). According to the official U.S. Greenhouse Gas Inventory, electric utilities in the United States were estimated to emit 2.039 billion tons, roughly 32 percent of the U.S. total in 2012 (EPA 2014). In 2014, fossil-fired generation accounted for 52 percent of TVA’s total electric generation, and the non-emitting sources of nuclear, hydro, and other renewables accounted for 48 percent. TVA has reduced its CO_2 emissions by about 30 percent from 2005 to 2014 and anticipates achieving a total CO_2 emission reduction of 40 percent by 2020.

3.2.2 Environmental Consequences

3.2.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and not cease operations at its former SWL and Ash Impoundment 2 or close either of those facilities. Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF, or haul CCR to an existing permitted landfill. Operation and maintenance activities would continue to generate small amounts of GHGs from equipment and vehicles used in operation and maintenance of the ash impoundments. However, because such emissions are negligible, no changes to climate would occur. Once capacity to manage CCR produced at SHF is exceeded, plant operations would have to cease as there would be no option for storage of CCR. Under this theoretical condition, plant emissions would be reduced within the immediate region unless another alternative was considered before that time. Because SHF provides base-load power for a large portion of TVA's service territory, stopping operations at SHF is not consistent with TVA's mission nor is continuing to operate SHF out of compliance with the CCR Rule consistent with this proposed project's purpose and need.

3.2.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

3.2.2.2.1 Construction

GHG emissions associated with construction of Alternative B relate to the emissions produced by equipment, primarily related to the combustion of gasoline and diesel fuels in vehicles, generators, and earth-moving equipment. Emissions would be associated with closure activities at the former SWL and Ash Impoundment 2, as well as with construction of the new onsite CCR Landfill. As described in Section 3.1, approximately 1.5 million cubic yards of material in Ash Impoundment 2 would be relocated to an adjacent portion of Ash Impoundment 2 as part of the closure-in-place through reduced footprint process. Additionally, borrow material would be hauled from the Shawnee East Site for use in closure of Ash Impoundment 2 and the former SWL (a roundtrip distance of approximately 3 miles). The movement of the CCR in Ash Impoundment 2 and borrow material would occur over the course of several years. The total amount of these emissions associated with the construction activities would be small and temporary in comparison to the existing aggregate emissions from SHF and the surrounding area, and would not adversely affect global GHG levels. Therefore, construction of this alternative would not result in impacts on climate change.

3.2.2.2.2 Operation

Emissions of GHGs during operations of Alternative B would be associated with the use of trucks to deliver CCR to the proposed CCR Landfill, and the use of earth-moving equipment to manage and cover the CCR material within the landfill. TVA estimates SHF would produce approximately 9,400 to 17,500 cubic yards of CCR per week. This would result in a total of 190 to 350 trips per day to transport CCR along the haul route from SHF to the proposed CCR Landfill based on a typical 5-day work week. The total amount of these emissions would be small in comparison to emissions in the vicinity, and would not adversely affect global GHG levels. Therefore, operation of this alternative would not result in impacts to climate change.

3.2.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

The closure of the former SWL and Ash Impoundment 2 would be the same under Alternative C as described previously for Alternative B. The Shawnee East Site would be used for borrow material for the closure of the Ash Impoundment 2 and the former SWL. The impacts of excavating this material and transporting it to the closure area would also be similar to the impacts evaluated under Alternative B.

3.2.2.3.1 Construction

Closure of the former SWL and Ash Impoundment 2 under Alternative C would have the same GHG emissions as those under Alternative B. There would be no GHG emissions associated with construction of a new landfill, as Alternative C would use the former SWL for CCR disposal. Overall, emissions from construction would be minor and would not contribute substantially to global GHG levels, and would not cause significant impacts to climate change. Emissions of GHGs from construction of Alternative C would be slightly lower than Alternative B because no emissions from construction of an onsite landfill would be generated.

3.2.2.3.2 Operation

No emissions of GHGs would be associated with the former SWL or Ash Impoundment 2 following completion of construction.

Under Alternative C, the dry CCR would be transported via truck to the offsite third-party landfill approximately 30 miles away. The same number of trucks would be used for Alternative C as with Alternative B, but the distance of transport would be more than 30 miles each way. Therefore, GHG emissions associated with operation of Alternative C would be higher than those associated with Alternative B. Overall, emissions from operation of Alternative C are still expected to be minor compared to regional emissions, would not contribute to substantially global GHG levels, and would not cause significant impacts to climate change.

3.3 Land Use

3.3.1 Affected Environment

No residential or commercial land uses occur in the immediate vicinity of Ash Impoundment 2 and former SWL. Residential land uses occur immediately adjacent to the Shawnee East Site.

The project area includes approximately 17 acres within the Ash Impoundment 2 and former SWL area and the approximately 205-acre Shawnee East Site. Both project locations are zoned for heavy industrial use (McCracken County and Paducah Geographic Information System 2016). The proposed closure activities would be located within previously developed lands at SHF within an area used for ash management. Land use within Ash Impoundment 2 and the former SWL project area is classified as open water, emergent wetlands, cultivated crops, developed space, and barren land (Figure 3.3-1). These waters and wetlands are not considered jurisdictional.

The proposed CCR Landfill would also be within SHF property boundaries at the currently undeveloped Shawnee East Site. Land use at the Shawnee East Site is classified primarily as cultivated crops and deciduous forest. Land use/land cover based on the National Land Cover Database (Homer et al. 2015) within the Shawnee East Site is identified in Table 3.3-1 and shown in Figure 3.3-1.

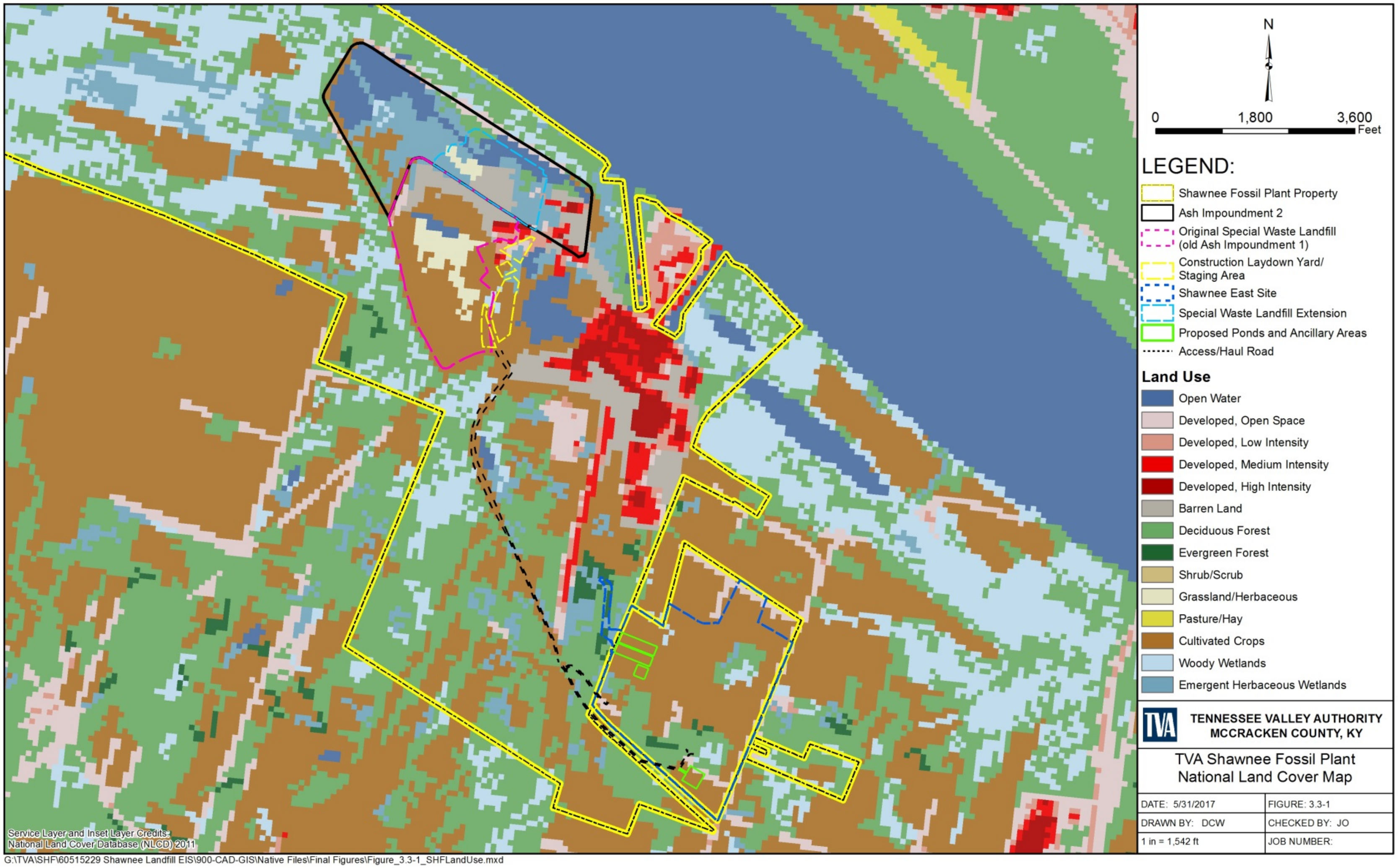


Figure 3.3-1. SHF Land Use

Table 3.3-1. Land Cover at the Shawnee East Site

Land Use Type	Acres
Developed, Open Space	13.6
Developed, Low Intensity	0.2
Deciduous Forest	38.3
Evergreen Forest	4.7
Cultivated Crops	133.0
Woody Wetlands	7.3
Emergent Herbaceous Wetlands	4.9

Source: 2011 National Land Cover Database

Land use in the vicinity of SHF includes agricultural, residential, and industrial areas. Land use within the region around the project sites as classified by the National Land Cover Database is mostly agriculture (cultivated crops) and deciduous forest (Figure 3.3-1). Other common land use types include hay/pasture land, various developed lands, and open water.

Industrial developed lands include the SHF plant site and the former PGDP located approximately 3 miles to the south of the proposed dewatering facility. However, the PGDP ceased operations in 2013 and is currently being decommissioned by the U.S. Department of Energy (DOE). Non-industrial developed lands consist of moderately developed lands associated with the city of Metropolis, Illinois.

3.3.2 Environmental Consequences

3.3.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and not cease operations at its former SWL and Ash Impoundment 2 or close either of those facilities. Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF, or haul CCR to an existing permitted landfill. As there would be no changes to plant operations, no changes to land use at SHF or in the vicinity would occur. Once capacity to manage CCR produced at SHF is exceeded, additional storage areas would need to be identified and evaluated to avoid affecting plant operations as there would be no option for storage of CCR. This alternative would not be consistent with the project purpose and need. Continuing to operate SHF out of compliance with the CCR Rule would also not be consistent with the project purpose and need.

3.3.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Because closure of the Ash Impoundment and former SWL is proposed to occur within an existing industrial area, construction would not result in conversion of any land uses. Construction impacts include potential temporary impacts to approximately 11 acres of partially developed land. Short-term impacts would include the temporary conversion of some vacant areas to laydown areas to support various construction-related activities. These short-term impacts would include the conversion of vacant areas to construction parking lots, laydown and stockpile areas, and temporary crew trailers and offices. Upon completion of construction activities, it is anticipated that these areas would be restored to their previous state. Land within the Ash Impoundment 2 and former SWL area is considered to be previously developed. The closure activities would not change the existing land use. Furthermore, the proposed land use of the site is consistent with the current use of the site. Therefore, there would be minor impacts to land use from the Ash Impoundment 2 and former SWL closure activities.

Construction of the proposed CCR Landfill would constitute a change in land use at the Shawnee East Site. Although the site is zoned for heavy industry, it is currently not developed as industrial. The parcels are currently agricultural or undeveloped. The change in active land use from primarily agricultural to industrial would constitute an adverse impact to land use. However, because the site is zoned industrial and is located on TVA property, it would be unlikely to be used for agriculture for the foreseeable future. Therefore, the impacts to land use would be minor.

3.3.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Because the closure of the Ash Impoundment and the former SWL project boundary and footprint would be the same under Alternative C as is described for Alternative B, the impacts to land use would also be the same. Therefore, implementation of Alternative C with respect to the closure activities would minor impacts on land use within the developed areas of SHF. The land within the Shawnee East Site would still be used for borrow for the closure of Ash Impoundment 2 and the former SWL under Alternative C. Therefore, impacts to land use at the Shawnee East Site would also be similar to those described under Alternative B.

The use of a permitted offsite landfill for CCR disposal would also have no direct impacts to land use. Impacts to land use at the offsite landfill would not be expected as the site is permitted and land use is already designated for landfill.

3.4 Prime Farmlands

3.4.1 Affected Environment

The Farmland Protection Policy Act was passed by Congress in 1981 as part of the Agriculture and Food Act (Public Law 97-98). It is intended to minimize the amount of farmland that is irreversibly converted from agricultural uses by federal activities. Prime farmland includes federally recognized prime farmland, unique farmland, and farmland of statewide or local importance. Projects are subject to Farmland Protection Policy Act requirements if they may irreversibly convert farmland (directly or indirectly) to nonagricultural use and are completed by a Federal agency or with assistance from a Federal agency (National Resource Conservation Service [NRCS] 2017).

Under the Farmland Protection Policy Act, federal agencies are required to consult with the NRCS regarding impacts. The NRCS uses a land evaluation and site assessment (LESA) system to establish a farmland conversion impact rating score on proposed sites of federally funded and assisted projects. This score is used as an indicator for the project sponsor to consider alternative sites if the potential adverse impacts on the farmland exceed the recommended allowable level. The Act does not prohibit the conversion of the land, but requires an assessment of alternative areas which are not prime farmland (NRCS 2017).

According to the NRCS soil data mapper, approximately 198 acres of the Shawnee East Site is considered either prime farmland or farmland of statewide importance, depending on drainage. Figure 3.4-1 shows the soils and Table 3.4-1 presents the soil types and farmland designation for the soils at the Shawnee East Site. Ash Impoundment 2 and the former SWL areas are not considered prime farmland (NRCS 2016). The 198 acres of prime farmland or farmland of statewide importance represents 0.16 percent of farmland in McCracken County. In 1982, Kentucky had 5.55 million acres of prime farmland. The most recent National Resources Inventory survey from 2012 showed that this had been reduced to 5.24 million acres, which represents a loss of approximately 300,000 acres of prime farmland state-wide in the last thirty years (U.S. Department of Agriculture 2015).

Table 3.4-1. Soils and Farmland Designations at the Shawnee East Site

Soil	Soil Name	Hydric Rating	Prime Farmland	Acres
CaA	Calloway Silt Loam, 0 to 2 percent slopes	3	Yes if drained	53.90
CaB2	Calloway Silt Loam, 2 to 4 percent slopes, eroded	0	All areas prime	21.27
Du	Dumps, coal and waste disposal areas	0	Not prime	4.81
GrB2	Grenada silt loam, 2 to 6 percent slopes, eroded	0	All areas prime	0.03
GrB3	Grenada silt loam, 4 to 6 percent slopes, severely eroded	0	Farmland of statewide importance	8.46
RtA	Routon silt loam, 0 to 2 percent slopes	87	Yes if drained	114.26
Total Acreage				**202.73**
Total Prime Farmland				**197.92**

3.4.2 Environmental Consequences

3.4.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and not cease operations at its former SWL and Ash Impoundment 2 or close either of those facilities. Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF, or haul CCR to an existing permitted landfill. As there would be no changes to plant operations, no changes to prime farmlands at SHF (or in the vicinity) would occur. Once capacity to manage CCR produced at SHF is exceeded, additional storage areas would need to be identified and evaluated to avoid affecting plant operations, as there would be no option for storage of CCR. This alternative would not be consistent with the project's purpose and need nor is continuing to operate SHF out of compliance with the CCR Rule.

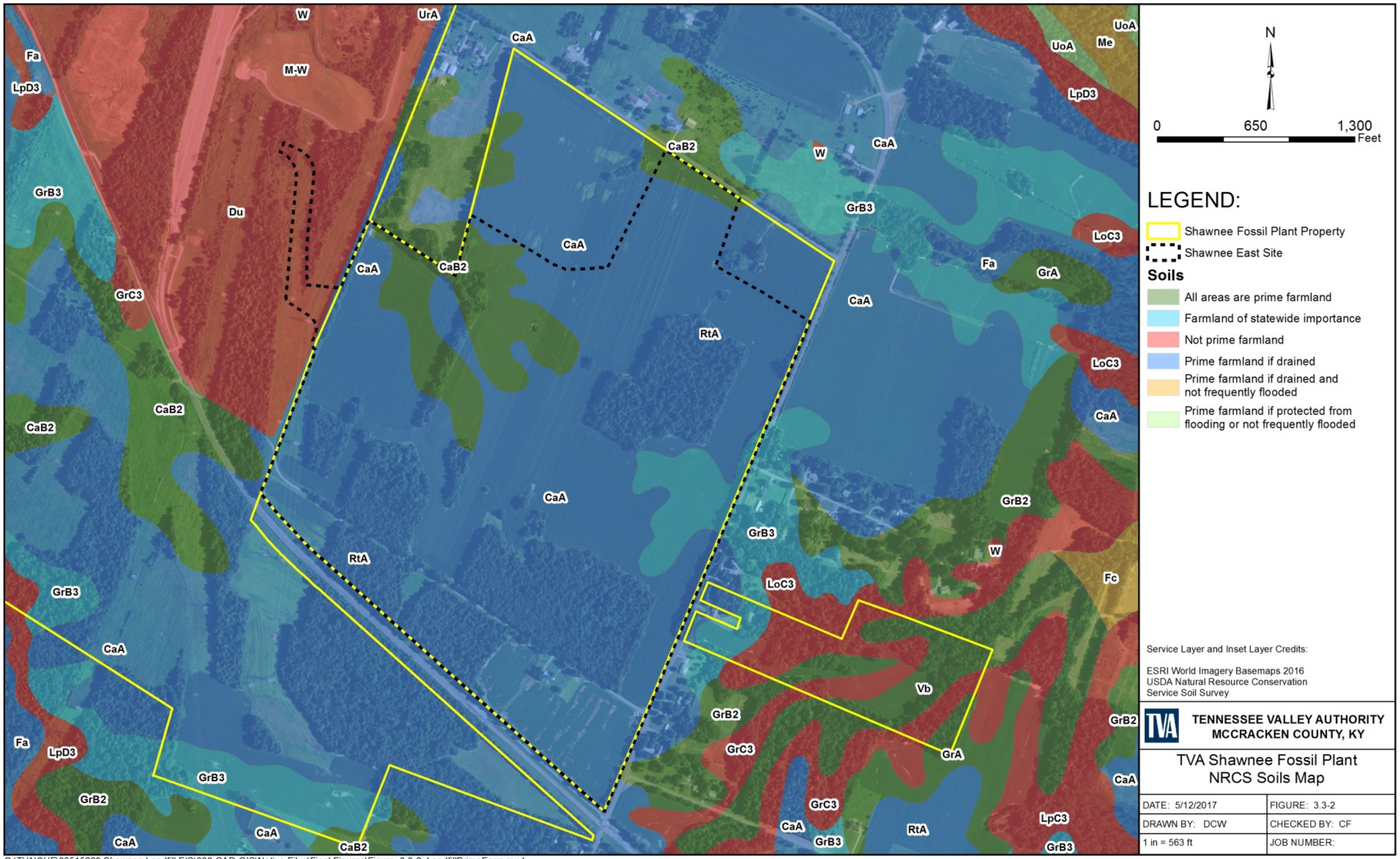


Figure 3.4-1. Prime Farmlands on the Shawnee East Site

3.4.2.2 Alternative B – Construction of Onsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

Because closure of Ash Impoundment 2 and the former SWL is proposed to occur within an existing industrial area, closure activities would not result in conversion of any prime farmlands or farmlands of statewide importance at the plant site.

The Shawnee East Site is currently classified as agricultural or undeveloped, and consists primarily of prime farmland or farmland of statewide importance. The construction of the landfill on this site would cause direct negative impacts to these farmlands. A Farmland Conversion Impact Rating (Form AD-1006) was completed by TVA and the NRCS to quantify the potential impacts to prime farmland or farmland of statewide importance on the Shawnee East Site. The impact rating considers the acreage of prime farmland to be converted, the relative abundance of prime farmland in the surrounding county, and other criteria such as distance from urban support services and built-up areas, potential effects of conversion on the local agricultural economy, and compatibility with existing agricultural use. Sites with a total score of at least 160 have the potential to adversely affect prime farmland. The impact rating score for the Shawnee East Site was 170 points (Appendix F). Ratings equal to or above 160 require federal agencies to consider alternative actions such as:

- Use of land that is not farmland or use of existing facilities;
- Alternative sites, locations, and designs that would serve the proposed purpose but convert either fewer acres of farmland or other farmland that has a lower relative values; and
- Special siting requirements of the proposed project and the extent to which an alternative site fails to satisfy the special siting requirements as well as the originally selected site.

Because the Shawnee East Site received a total score above 160, TVA reevaluated four of the site alternatives previously considered (see Section 2.1.1) for prime farmland. Form AD-1006 was also completed for a Shawnee East Expanded site of approximately 238 acres as well as Landfill Siting Study Options 1, 2, and 3. These three sites received impact rating scores of 170, 173, 172, and 175 respectively (Appendix F). The total impact rating scores for all four of these site alternatives were equal to or higher than the Shawnee East Site. The Shawnee East Site, therefore, remains the preferred site. The project would convert a total of approximately 0.16 percent of prime farmland in McCracken County, Alabama to non-agricultural use.

As described in Subsection 3.3.2, as of 2008, McCracken County had over 74,000 acres of tillable land (McCracken County Agriculture Development Council 2008). Due to the large amount of agricultural land in the vicinity, the loss of the approximately 198 acres of prime farmland within this site would be minor as Kentucky has 5.24 million acres of prime farmland. Therefore, overall impacts to prime farmlands associated with Alternative B are considered minor. Indirect impacts to land use are not anticipated under this alternative.

3.4.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

Because the closure of Ash Impoundment 2 and the former SWL would be the same under Alternative C as is described for Alternative B, the impacts to prime farmland would also be the same for these activities. Therefore, implementation of Alternative C with respect to the closure activities would have no impact on prime farmlands within the developed areas of SHF.

The land within the Shawnee East Site would still be used for borrow for the closure of Ash Impoundment 2 and the former SWL under Alternative C. Therefore, impacts to prime farmlands at the Shawnee East Site would also be similar to those described under Alternative B.

The use of a permitted offsite landfill for CCR disposal would also have no direct impacts to prime farmlands. Impacts to prime farmlands at the offsite landfill would not be expected as the site is permitted use is already designated for landfill.

3.5 Geology and Seismology

3.5.1 Affected Environment

3.5.1.1 Geology

Geologically, SHF lies at the northeastern limit of the Mississippi Embayment and within the Gulf Coastal Plain Physiographic Province. The predominant natural features of the site, most evident prior to plant construction, are the recent floodplain of the Ohio River as well as the low upland terrace developed on loess deposits (Kellberg 1951). The Ohio River floodplain along the river bank averages about 2,000 feet in width. The floodplain is characterized by a natural levee immediately adjacent to the river and a lower, locally swampy area, extending south of the levee to the base of the upland terrace. At the southern margin of the floodplain, the topography rises some 20 to 30 feet to a relatively flat upland terrace bench. Most of the plant facilities are situated on this terrace (TVA 2005).

The soil mantle beneath SHF and the Shawnee East Site is made up of more than 300 feet of unconsolidated deposits of clay, silt, sand, and gravel, ranging from Cretaceous to Holocene in age (Figure 3.5-1). These continental sediments were deposited on an irregular erosional surface consisting of several terraces, and have a total thickness ranging from less than 1 foot to approximately 120 feet.

Surface deposits at SHF consist of a combination of loess and alluvium. These deposits are generally 5 to 25 feet thick, and in some areas have been completely reworked during facility construction and ash placement. They have little capacity for lateral groundwater movement thus generally allow vertical migration of precipitation and runoff to lower formations.

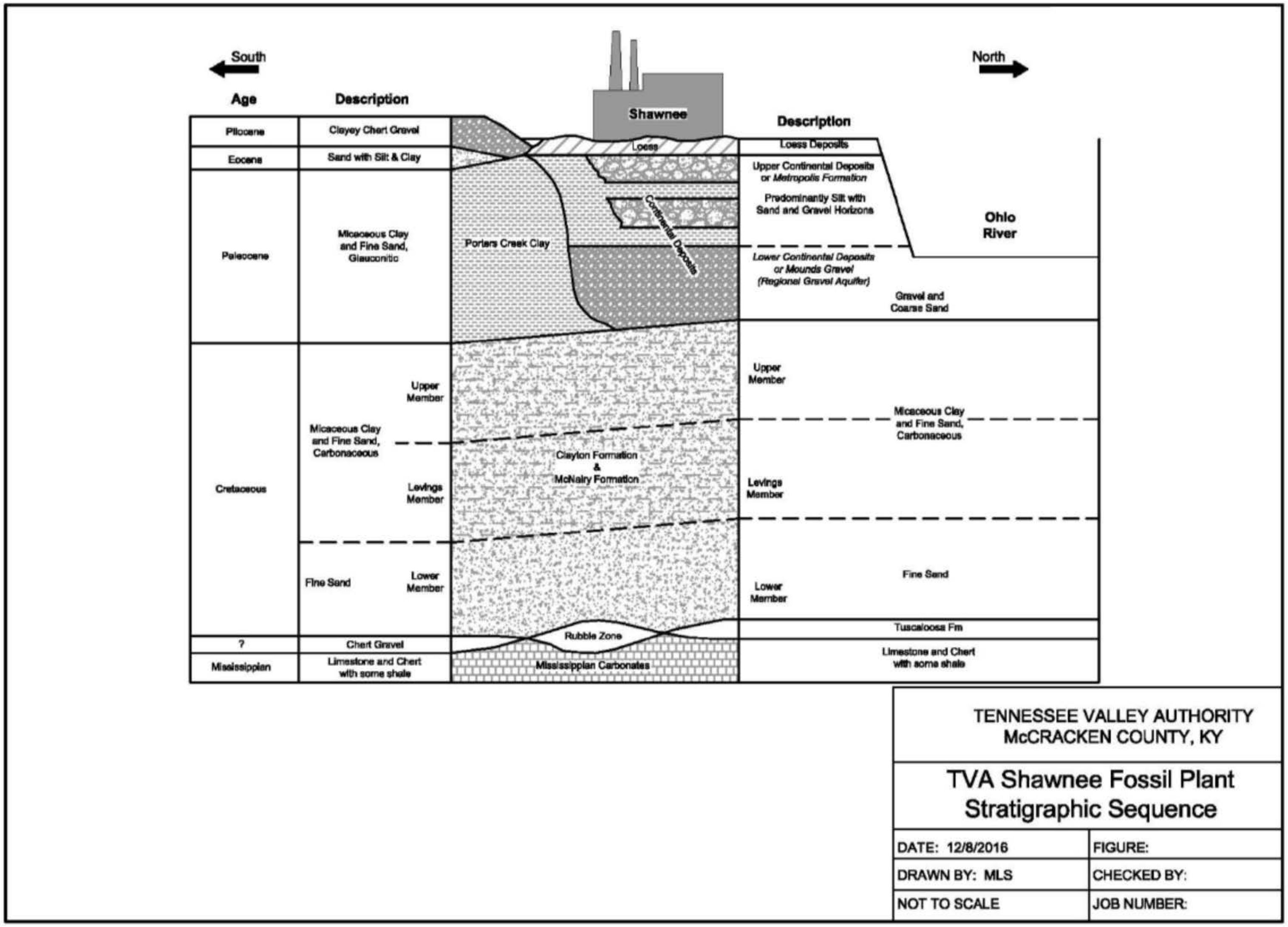


Figure 3.5-1. SHF Stratigraphic Sequence

Beneath the loess and alluvium, are the Upper Continental Deposits (UCD) and Lower Continental Deposits (LCD). Minor deposits of clay and gravel within the UCD affect local groundwater flow. Thickness of the upper terrace sediments ranges from 15 feet to 55 feet in the region. The lower gravel unit and associated sand layers within the LCD are commonly referred to as the Regional Gravel Aquifer (RGA), the principal aquifer in the region. Historic test borings in the area indicate RGA thicknesses of 30 feet to 65 feet. Regionally, the RGA is thinner near the Ohio River, and the thickness increases with distance from the river (Boggs and Lindquist 2000). The RGA is discussed further in Section 3.6, Groundwater.

3.5.1.2 Seismology

As described in Subsection 3.5.1.1, SHF lies at the northeastern limit of the Mississippi Embayment within the Gulf Coastal Plain Physiographic Province. The thick deposits of sediments within the Mississippi Embayment have a significant effect on earthquake ground motions. Earthquakes in northwestern Kentucky are dominated by events originating in the New Madrid Seismic Zone, a cluster of earthquake hypocenters between 3.1 and 9.3 miles (5 and 15 kilometers [km]) deep, located about 15.5 miles (25 km) from SHF. In late 1811 to early 1812, a series of three large earthquakes and aftershocks occurred near New Madrid, Missouri. Damage from these earthquakes occurred over 600,000 square kilometers and the ground motions were perceived as far away as New York City and Washington D.C. (USGS 2017).

Although damaging earthquakes are only moderately likely in northwestern Kentucky, the 300 feet or more of saturated and unconsolidated clay, silt, sand, and beneath SHF has a significant effect upon earthquake ground motions (Geocomp 2016). Differential stresses of an earthquake can cause saturated, unconsolidated sediment to flow like a liquid (termed liquefaction), possibly with sand blow formation. The 1811 New Madrid earthquake and its aftershocks caused liquefaction and sand blows, as well as subsidence and landslides as far away as Chicasaw Bluffs and Reelfoot Lake in Tennessee (USGS 2017). The site-specific seismic study conducted for SHF is based on seismic safety requirements developed by the USGS and articulated in the CCR Rule.

As required by the Final CCR Rule, within 18 months of the publication date (April 17, 2015), an initial structural integrity evaluation for seismic loading is required and must include initial assessments of seismic factor of safety and liquefaction factor of safety for each existing CCR surface impoundment that meets the following conditions:

1. Has a height of 5 feet or more and a storage volume of 20 acre-feet or more; or
2. Has a height of 20 feet or more.

The seismic and liquefaction factor of safety assessments must document whether the calculated factors of safety for the critical cross section of each existing CCR surface impoundment achieve the minimum factors of safety specified in the CCR Rule. The owner or operator of the existing CCR surface impoundment may elect to use a previously completed assessment to serve as the initial assessment provided that the previously completed assessment(s) was completed no earlier than 42 months prior to October of 2016, and meets the applicable requirements.

TVA completed a subsurface and laboratory investigation, seismic stability evaluation, and liquefaction assessment for SHF Ash Impoundment 2 in October 2016. The following discussion describes the results of the Ash Impoundment 2 analysis.

Based upon review of subsurface investigations and laboratory analysis in 2015 along with data collected in 2010, 2011, and 2013, representative safety factors for Ash Impoundment 2 were determined as summarized below in Table 3.5-1 (Geocomp 2016). The seismic factor of safety shown in Table 3.5-1 was evaluated using Ash Impoundment 2 water level and groundwater surface data provided by TVA and a seismic displacement of 18 inches (Geocomp 2016).

The liquefaction factor of safety shown in Table 3.5-1 was calculated to evaluate the stability of SHF Ash Impoundment 2 under post-earthquake conditions. Under liquefaction hazard evaluation, the plasticity of soils is assumed to be sand-like or clay-like. Typical plasticity for sand-like soils is less than 7; making them susceptible to liquefaction. Conversely, clay-like soils exhibit a higher plasticity and are less susceptible to liquefaction (Geocomp 2016).

Based upon the data in Table 3.5-1, it was concluded that calculated safety factors for SHF Ash Impoundment 2 meet or exceed the requirements specified in the EPA Final CCR Rule (Geocomp 2016).

Table 3.5-1. Summary of Safety Factors for SHF Ash Impoundment 2

EPA Criteria	CCR Rule Reference	EPA Required Factor of Safety	Calculated Factor of Safety
Seismic Factor of Safety (Pseudo-static stability)	257.73(e)(1)(iii)	≥ 1.00	1.11
Liquefaction Factor of Safety (Post-earthquake stability)	257.73(e)(1)(iv)	≥ 1.20	1.98

Source: Geocomp 2016

3.5.2 Environmental Consequences

3.5.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and would not cease operations at its former SWL and Ash Impoundment 2 or close either of those facilities. Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF, or haul CCR to an existing permitted landfill. Once capacity to manage CCR produced at SHF is exceeded, plant operations would be impacted as there would be no option for storage of CCR produced at SHF unless an alternative location was identified and analyzed. As there would be no changes to the project area, there would be no impacts to geology and seismology associated with this alternative.

3.5.2.2 Alternative B – Construction of Onsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

Closure of the former SWL and SHF Ash Impoundment 2 would involve dewatering and hauling CCR from the west end of Ash Impoundment 2 to the Ash Impoundment 2/former SWL consolidation area, grading the impoundments to be seismically stable, and capping them with a cover system meeting or exceeding CCR standards to maintain positive drainage while controlling infiltration and releases. Local geology subject to the influences of Ash Impoundment 2 and the former SWL would be beneficially impacted by closure activities at these onsite facilities.

Construction impacts include potential temporary impacts to approximately 11 acres of partially developed land. Short-term impacts would include the temporary conversion of some vacant areas to support various construction-related activities, such as areas used for construction parking lots, laydown and stockpile areas, and temporary crew trailers and offices. During construction, BMPs would be utilized to minimize soil disturbance and erosion, thus minimizing possible impacts to the local geology. Upon completion of construction activities, it is anticipated that these temporarily affected areas would be restored to their previous state.

Construction of the proposed CCR Landfill on the Shawnee East Site would impact the geology in that area. Although the site is zoned for heavy industry, it is currently agricultural or undeveloped, with an intermittent stream and several small wetland areas and ponds. The surface would be cleared and grubbed, and upper layers of soil would be excavated for use as borrow material for the closure activities at Ash Impoundment 2 and the former SWL, and for construction of the proposed CCR Landfill. These activities would increase the potential for soil erosion; however, the use of BMPs and the SWPPP would minimize the potential for impacts associated with soil erosion and deposition due to these ground-disturbing activities. The excavation of native soils for use as borrow material and for the construction of the proposed CCR Landfill would substantially change the geology within the footprint of the proposed landfill. Approximately 205 acres would be disturbed within the proposed landfill property, including the area to be excavated. Therefore, direct and indirect impacts to the soils and geology at the Shawnee East Site would be expected to be substantial within the disturbed area, but would be minor in the context of the geology resources of the surrounding region.

The seismology of the region potentially could affect geology if the closed units constructed under Alternative B were not seismically stable. There are two general categories of earthquake hazards: primary and secondary. Primary hazards include fault ground rupture and strong ground shaking. If an earthquake is larger than about magnitude 5.5, ground rupture may occur on the fault. The amount of displacement generally increases with the magnitude of the earthquake. Structures located on a fault can be displaced or damaged by fault ground rupture. The best mitigation for potential fault ground rupture to structures is to accurately locate the fault and set back structures a safe distance from the fault. Where structures and other facilities cannot be located to avoid faults, there are several geotechnical and structural design measures that can be implemented to mitigate the potential for fault ground rupture. While there are quaternary faults located in the Metropolis, Illinois area across the Ohio River, none are currently known within the SHF boundaries or immediate vicinity (USGS 2014). Therefore, impacts associated with fault ground rupture would not be anticipated.

Secondary earthquake hazards include liquefaction/lateral spreading, landsliding, and ground settlement. Liquefaction is essentially loss of strength in generally granular, saturated materials including alluvial and fluvial deposits subjected to ground shaking. Liquefaction can result in ground settlement, and where there is a free face such as a river bank, can result in ground spreading toward the free face. Liquefaction can damage foundation, pavement, pipelines, and underground utilities. Earthquake-induced landsliding can occur where slopes are present or where colluvial deposits or unstable materials are present on slopes. Ground settlement can occur in soft, weak materials including non-engineered fill, due to ground shaking. Liquefaction, landsliding, and ground settlement can all be mitigated, if present, with adequate siting and with various geotechnical and structural design measures, including ground improvements and adequate foundation design.

Onsite and local geologic and geomorphic features within the Shawnee East Site were evaluated during the hydrogeologic investigation of the site. The proposed CCR Landfill facility has been seismically designed to withstand a probabilistic earthquake. Therefore, the potential for impacts to geology associated with seismological conditions at the site would be minor under Alternative B.

3.5.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

Because the project boundary and footprint of the closure of Ash Impoundment 2 and the former SWL would be the same under Alternative C as is described for Alternative B, the impacts to geology associated with the seismological conditions on the site would also be the same. Excavation of soils within the Shawnee East Site would still occur to provide borrow material for the onsite closure activities, but the proposed landfill would not be constructed. Therefore, impacts to geology at the Shawnee East Site would be smaller than those under Alternative B.

Use of a permitted offsite landfill for CCR disposal under Alternative C would result in impacts to geology at the location of the offsite landfill; however, the use of BMPs, and adherence to permit conditions, would minimize both construction and operational impacts to geology in that area.

3.6 Groundwater

3.6.1 Affected Environment

3.6.1.1 Regional Aquifers

Regionally significant aquifers and water-bearing units that occur near SHF are the Paleozoic bedrock, McNairy Formation, Lower Wilcox Aquifer, Pliocene and Pleistocene sands and gravel deposits, and Quaternary alluvial deposits. Regional aquitards include the Porters Creek Clay and UCD. The hydrogeological characteristics of the geologic units are described as follows:

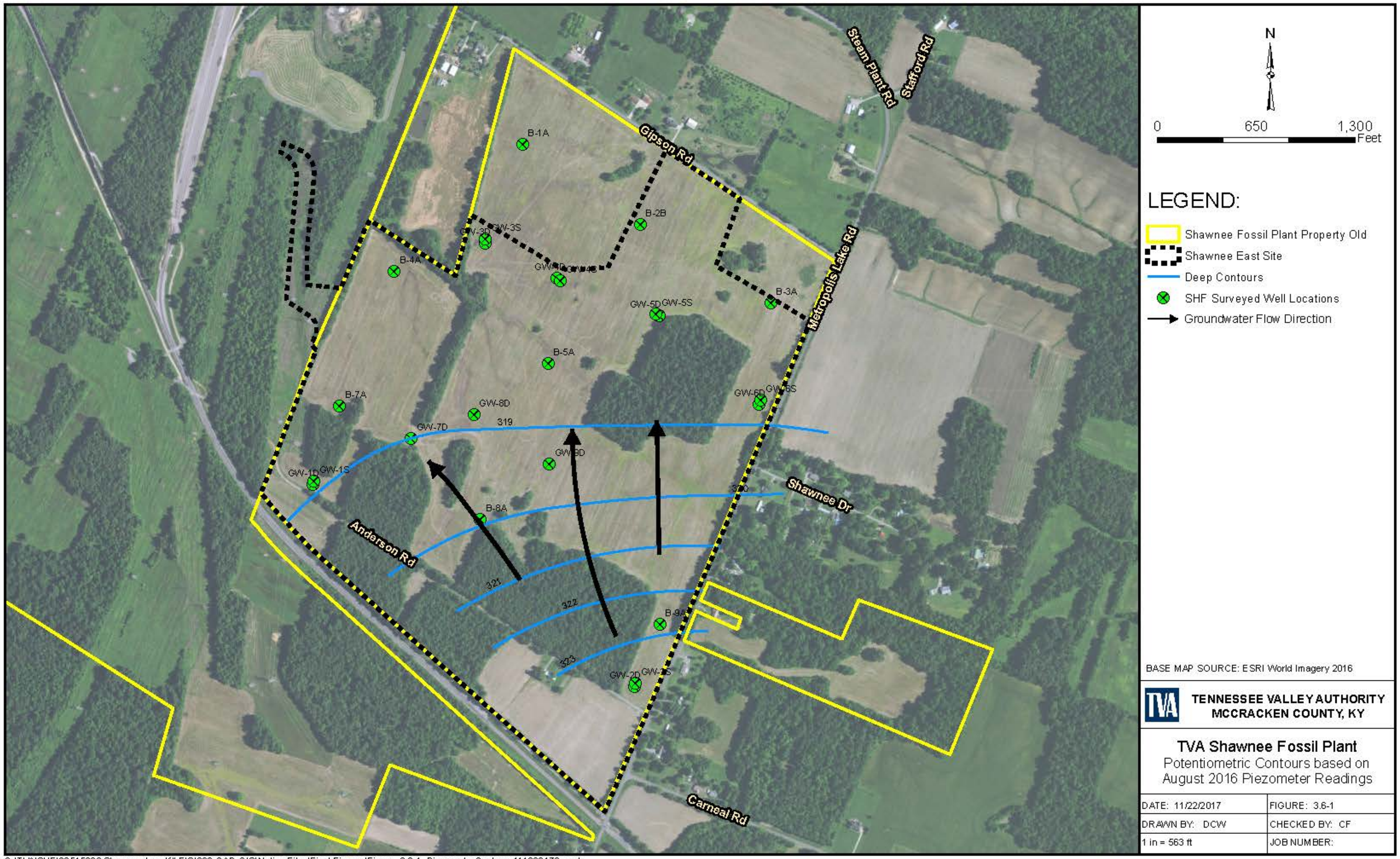
- Paleozoic Bedrock Aquifer: The Mississippian-aged, Warsaw Limestone bedrock located approximately 300 to 400 feet beneath the site. This aquifer is reported to yield 240 to 1,500 gallons per minute from joints and a zone of weathered rock near the top of bedrock.
- McNairy Formation: This formation is reported to be located at a depth between approximately 70 and 100 feet beneath the ground surface. The deposit is variable and serves as an important aquifer in the southeastern portion of the region where it is mostly sand. Near the site, the formation predominantly consists of clay and is a poor aquifer. Groundwater flow within this formation is toward the Ohio River.
- Porters Creek Clay: Where present, this formation acts as an aquitard between the McNairy Formation and overlying aquifers. Some minor sand layers within the clay can provide groundwater supplies, but this formation is not considered an aquifer. This geologic unit is reported to be absent near the site due to erosion.
- Lower Wilcox Aquifer: Where present, the Wilcox Formation overlies the Porters Creek Clay. Sand horizons are difficult to distinguish from layers in the overlying Claiborne Group. Collectively, these sand deposits are referred to as the Lower Wilcox Aquifer. This aquifer yields enough groundwater for commercial and domestic purposes. Like the Porters Creek Clay, it is reported to be absent near the site. Groundwater flow within this aquifer is toward the west.
- Pliocene and Quaternary Gravels: These gravels consist of deposits also known as the Continental Deposits and recent alluvial deposits near the Ohio River. The gravels are difficult to distinguish and are treated here as a single aquifer. The Continental Deposits are divided into an upper and a lower unit. The gravel deposits are found in the lower unit. The upper unit consists of sand, silt, and clay, which acts as a confining layer for the gravel. Where the gravel deposits are thick enough, they serve as an aquifer. These deposits are known as the RGA, which is a primary local aquifer. Yields of up to 1,000 gallons per minute have been reported. The groundwater flow direction within this aquifer is toward the Ohio River. Groundwater flow within the upper continental deposits is reported to flow vertically downward into the RGA (Stantec 2017).

3.6.1.2 SHF Groundwater (including Ash Impoundment 2 and the former SWL)

Section 3.5.1 describes the soil mantle beneath the plant site as consisting of more than 300 feet of unconsolidated deposits of clay, silt, sand, and gravel, ranging from Cretaceous to Holocene in age (Figure 3.6-1).

Surface deposits at SHF consist of a combination of loess and alluvium. These deposits are generally 5 to 25 feet thick, and in some areas have been completely reworked during facility construction and ash placement. They have little capacity for lateral groundwater movement; generally following vertical migration of precipitation and runoff to lower formations.

Beneath the loess and alluvium are the UCD and LCD. The UCD are characteristically fine-grained and consist primarily of silt with sand and gravel horizons. The lower gravel unit and associated sand layers are commonly referred to as the RGA, the principal aquifer in the site



G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Final Figures\Figure_3.6-1_PiezometerContours111620172.mxd

Figure 3.6-1. Potentiometric Contours at the Shawnee East Site

region. Historic borings in the area indicate RGA thicknesses of 30 feet to 65 feet. Regionally, the RGA thins toward the Ohio River, with thickness increasing with distance from the river (Boggs and Lindquist 2000).

The RGA is a semi-confined aquifer above the relatively low permeability of the tight silt and clay of the McNairy formation. Units above the RGA primarily have downward flow; allowing percolation of surface water and precipitation into the RGA. In the region, groundwater flow in the RGA is primarily towards the Ohio River and its tributaries.

As described in the PEIS Part I, Section 3.6, there is a distinction between the uppermost aquifer and the point at which groundwater is first encountered. In 40 CFR § 257.53(a), the term uppermost aquifer is defined as “a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.” Thus, the identification of the uppermost aquifer may include considerations of water quality and yield (EPA 2016c). Unlike the water-bearing unit that is first encountered, which does not yield a significant amount of water, the RGA consistently yields usable quantities of water and is considered the principal aquifer in the region. The groundwater quality is described in Section 3.6.1.4.

3.6.1.3 Shawnee East Site Groundwater

The uppermost aquifer at the Shawnee East Site is also the RGA. Geotechnical studies were performed at the Shawnee East Site from June through December 2016, including piezometer studies. The highest readings between July and December 2016 were used to create a piezometric surface to determine at what depth groundwater was likely to be encountered. Measured groundwater levels ranged from elevation 323 feet (B-8A, December 2016 reading) to 357 feet (B-5A, August, 2016 reading). In general, the readings were higher in summer (July and August 2016) than winter (December 2016). Figure 3.6-1 shows the potentiometric contours based on the most recent readings from September 2017 (Stantec 2017).

3.6.1.4 Groundwater Quality

The former SWL solid waste permit (permit number: SW07300041) required both groundwater sampling and surface water sampling twice per year (KDEP 2005). This permit required groundwater sampling for boron, chemical oxygen demand, chloride, dissolved copper, fluoride, molybdenum, total dissolved solids, total organic carbon, specific conductance, sulfate, temperature, vanadium, and pH. Copper and fluoride have upper limits while all other constituents must either meet statistical limits or are only reported. Additional parameters sampled semi-annually included total alpha, aluminum, arsenic, barium, beryllium, total beta, bicarbonate alkalinity, cadmium, calcium, cobalt, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, strontium, thallium, thorium, titanium, uranium, and zinc.

SHF’s former SWL was placed in Groundwater Assessment status in February 2011 by the Kentucky Division of Waste Management. This action resulted from statistical exceedances for several constituents in 2010 during drought conditions. However, no constituents have exceeded maximum contaminant levels (MCLs), except for gross beta particle activity (an indicator of radionuclides in the groundwater), since 2011. The gross beta particle activity exceedance is attributed to historical contamination of the RGA originating from the former PGDP facility, and is not associated with TVA actions at SHF.

The groundwater monitoring network includes 14 total wells for which samples were collected, from water bearing units in the alluvium, the UCD, and the RGA. Three wells collect background water samples (one for each water bearing unit). These background samples provide a source for comparison to determine if activities and facilities at SHF contribute to groundwater issues. Eleven former permitted wells are located downgradient from SHF in the direction of groundwater flow. There are four downgradient wells for the alluvium, two for the UCD, and five for the RGA. Based upon sediment boring logs collected during well installation and the presence of groundwater in existing wells, the alluvial and UCD formations are not continuous in the area (they are not found in a connected, uninterrupted layer) and have limited amounts of groundwater. While the alluvial and UCD formations are water-bearing units, the RGA is considered the only continuous, as well as uppermost aquifer across the SHF (TVA 2016a).

May 2017 groundwater monitoring results included statistical exceedances of limits for gross alpha, aluminum, boron, calcium, cobalt, fluoride, iron, magnesium, manganese, molybdenum, nickel, pH, potassium, specific conductance, strontium, sulfate, total organic carbon, and total dissolved solids in downgradient wells from the former permit program.[7] (TVA 2017a). With no exceedances of the MCLs in wells since 2011, the groundwater meets drinking water standards. The former MCL exceedances were associated with sediment accumulation in the wells, and the sampling procedures by which those samples were collected. New wells were developed and sampling procedures improved which eliminated further MCL exceedances. Until September 21, 2017, when the former SWL and Ash Impoundment 2 were transferred to a Registered Permit by Rule, reports were semi-annual. Now groundwater will be monitored in accordance with the CCR rule to meet both state and federal requirements.

The DOE PGDP is upgradient of the former SWL and Ash Impoundment 2, and has had a contaminant plume in the RGA which has moved into the SHF reservation. At one time, several wells reflected impact by the plume with leading edge contaminants of Technetium 99 (Tc-99) and Trichloroethylene (TCE). Currently, due to pump and treat remedial work occurring, the plume has receded and now affects only one well at the main plant, and two wells at the Shawnee East Site. DOE has a Water Policy Boundary executed, which requires no one within the boundary to use the groundwater. The SHF reservation in its entirety falls within this boundary. Due to the proximity of the PGDP, groundwater in the immediate vicinity is not used for drinking water and private wells in the area have been capped and sealed.

Progress in the long-term cleanup at the DOE PGDP from continued, active groundwater remediation is modeled every two years. The primary constituents modeled for the PGDP plume in the RGA are trichloroethylene (TCE) and technetium-99. In the 2014 report, the modeled groundwater plumes of these contaminants were similar to 2010 results, with notable exceptions in the Northwestern Plume. For this plume, the TCE contamination was projected to have reduced in areal extent near the extraction wells. These changes indicate continued, active groundwater remediation at the PGDP is making progress (DOE 2014).

3.6.2 Environmental Consequences

3.6.2.1 Alternative A – No Action

Under Alternative A, no construction activities would be undertaken by TVA, and there would be no changes to the management of CCR. Therefore, there would be no changes to groundwater use or quality.

3.6.2.2 Alternative B – Construction of Onsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

During construction, BMPs would be utilized to minimize soil and vegetation disturbances and soil runoff; thus minimizing possible impacts to groundwater from construction activities. Upon completion of construction, temporarily disturbed areas, such as the laydown yards, would be restored to their previous state; therefore, direct and indirect construction-related effects to groundwater would be minor, temporary, and localized.

As part of Alternative B, the dewatering of surface water and subsequent stabilization of the CCR materials in Ash Impoundment 2 would provide an immediate reduction in the potential release of CCR constituents from the impoundment. Under Alternative B, surface water and all contributing surface inputs would be minimized or reduced, resulting in a reduction of hydraulic head and infiltration to groundwater below Ash Impoundment 2 and general improvement in groundwater quality. Additionally, the installation of an approved closure cover system would essentially eliminate rainfall infiltration and hydraulic head driving CCR constituents to the groundwater. Closure-in-place activities will reduce the potential for impacts to groundwater and improve water quality in comparison to the No Action Alternative. Alternative B provides the following benefits:

1. Elimination of pooled process water reduces the hydraulic head, thereby reducing the pressure of water forcing CCR constituents into groundwater.

2. Installing a cover system improves groundwater quality by virtually eliminating rainfall infiltration through the impoundment, and reducing downward migration of CCR constituents into groundwater.

3. KPDES outfall water quality improves as contact with CCRs would cease following installation of a cover system. In theory, the receiving river water quality would also be expected to improve, though since impact already is negligible, improvements would be as well.

4. Natural groundwater quality would eventually be reestablished (TVA 2016b).

Additional post-closure requirements would be required to maintain compliance with the CCR Rule. TVA would implement supplemental mitigation measures that include monitoring, assessment, and corrective action programs as mandated by state requirements and the CCR Rule. Such measures would further minimize risk from closed impoundments (TVA 2016a). This would be considered a minor beneficial impact to groundwater in the vicinity.

The closure of the former SWL would have similar direct and indirect impacts on groundwater quality. The installation of an approved closure cover system would essentially eliminate rainfall infiltration and hydraulic head driving CCR constituents to the groundwater.Construction of the proposed CCR Landfill would impact the groundwater in the area of the landfill property. Although the site is zoned for heavy industry, it is currently agricultural or undeveloped land with an intermittent stream and several small wetland areas and ponds. The proposed site is within the documented PGDP contamination plume; so drinking water wells in the vicinity are capped and locked. BMPs would be employed to minimize construction impacts to groundwater. Construction of the lined, engineered landfill would eliminate CCR constituents from entering the soil and groundwater below the bottom landfill liner. A leachate collection system reduces that potential to a greater degree. Additionally, capping of the landfill with an approved closure cover system, during eventual closure activities would further reduce the potential for any impact to groundwater in the area. Therefore, with the use of BMPs and adherence to CCR Rule requirements, impacts to groundwater associated with construction of the proposed CCR Landfill would be minor, temporary, and localized.

The proposed CCR Landfill design would incorporate a geomembrane liner system that meets CCR Rule performance standards ($1x10^{-7}$) permeability. The liner system would utilize a synthetic liner in combination with a compacted clay liner. The proposed CCR Landfill design would incorporate requirements designed to reduce groundwater impacts including a storm water management system, leachate migration control standards, a geosynthetic cap system, and a groundwater monitoring program as required by the CCR Rule. Therefore, under Alternative B, the existing monitoring well network at SHF (including Ash Impoundment 2 and the former SWL) would be expanded to include another monitoring network at the proposed CCR landfill site.

Overall, the implementation of Alternative B would be beneficial to groundwater as compared to Alternative A – No Action. With respect to the closure activities, reduction of the hydraulic head by decanting surface water, in addition to the removal of potential additional hydraulic inputs from precipitation, surface water runoff, or other water additions to the impoundment, would effectively reduce potential release of CCR constituents to groundwater. These measures would further minimize groundwater risk related to the closed impoundment. Therefore, in consideration of the beneficial effects of removal of the hydraulic head from a closed impoundment, the associated reduction in infiltration from the CCR impoundment, and the commitment to supplemental mitigation measures, the direct and indirect impacts of Alternative B on groundwater with respect to closure of the former SWL are minor but beneficial as compared to the No Action Alternative.

It is also anticipated that operation of the proposed CCR Landfill would not have a substantial impact to groundwater as the new landfill would be required to maintain a liner system, leachate collection system, as well as an engineered cap upon closure, to minimize water flow through the CCRs. Therefore, with the use of BMPs and adherence federal regulations, impacts to groundwater from operation of the proposed CCR Landfill are expected to be minor.

3.6.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Because the closure of Ash Impoundment 2 and the former SWL would be the same under Alternative C as Alternative B, the impacts to groundwater would also be the same. Use of the Shawnee East Site for borrow material for the closure activities would also have the same effects as the construction impacts described under Alternative B. Therefore, implementation of Alternative C would have only localized, minor impacts to groundwater.

Use of an existing offsite permitted landfill under Alternative C would result in no additional direct or indirect impacts to groundwater resources that have not already been considered with the former SWL landfill. Therefore, only minor impacts to groundwater are expected to occur under this alternative.

3.7 Surface Water

3.7.1 Affected Environment

The SHF site is located on the Ohio River, 35 miles upstream of its confluence with the Mississippi River (Ohio River Mile [ORM] 946). The plant is bordered by the Ohio River and Little Bayou Creek, which are both classified as warm-water aquatic habitat (Figure 3.7-1). The 7Q10 flow (lowest stream flow for seven consecutive days that would be expected to occur once in 10 years) at the SHF discharge points on the Ohio River is 46,300 cubic feet per second, and on the Little Bayou Creek is 0 cubic feet per second (KDEP 2005).

The TVA SHF facility discharge is located between Lock and Dam 52 at ORM 938.9 and Lock and Dam 53 at ORM 962.6. These two locks and dams are controlled and operated by the United States Army Corps of Engineers (USACE), and are being replaced by the Olmstead Locks and Dam at ORM 964.4. Work on the new Olmstead Locks is complete and work on the new dam is ongoing. Olmstead Dam does not currently provide any regulation of the river and in recent years there have been large swings in river elevations (USACE 2014). The average monthly stream flow is approximately 267,700 cubic feet per second. Generally, the Ohio River's average depth is 24 feet and at its widest point is 1 mile across at Smithland Dam, about 27 miles upstream of SHF (Ohio River Valley Water Sanitation Commission 2014).

The reach of the Ohio River bordering Kentucky supports aquatic life and drinking water use. Primary contact recreation (water bodies suitable for full immersion swimming) is impaired for nearly 350 stream miles, or about 53 percent of the river in Kentucky. The pollutant causing this impairment is the pathogen indicator, *E. coli*. No reaches of the Ohio River fully support all assessed uses. This limitation is often a result of combined sewer overflows during and immediately following rainfall events along the riverfront and downstream of urban areas. The Kentucky reach of the Ohio River only partially supports fish consumption because of polychlorinated biphenyls (PCBs) and dioxin, while methylmercury residue in fish tissue is a cause of impairment in many of the river miles. The river reach from ORM 981.3 - 938.9, which

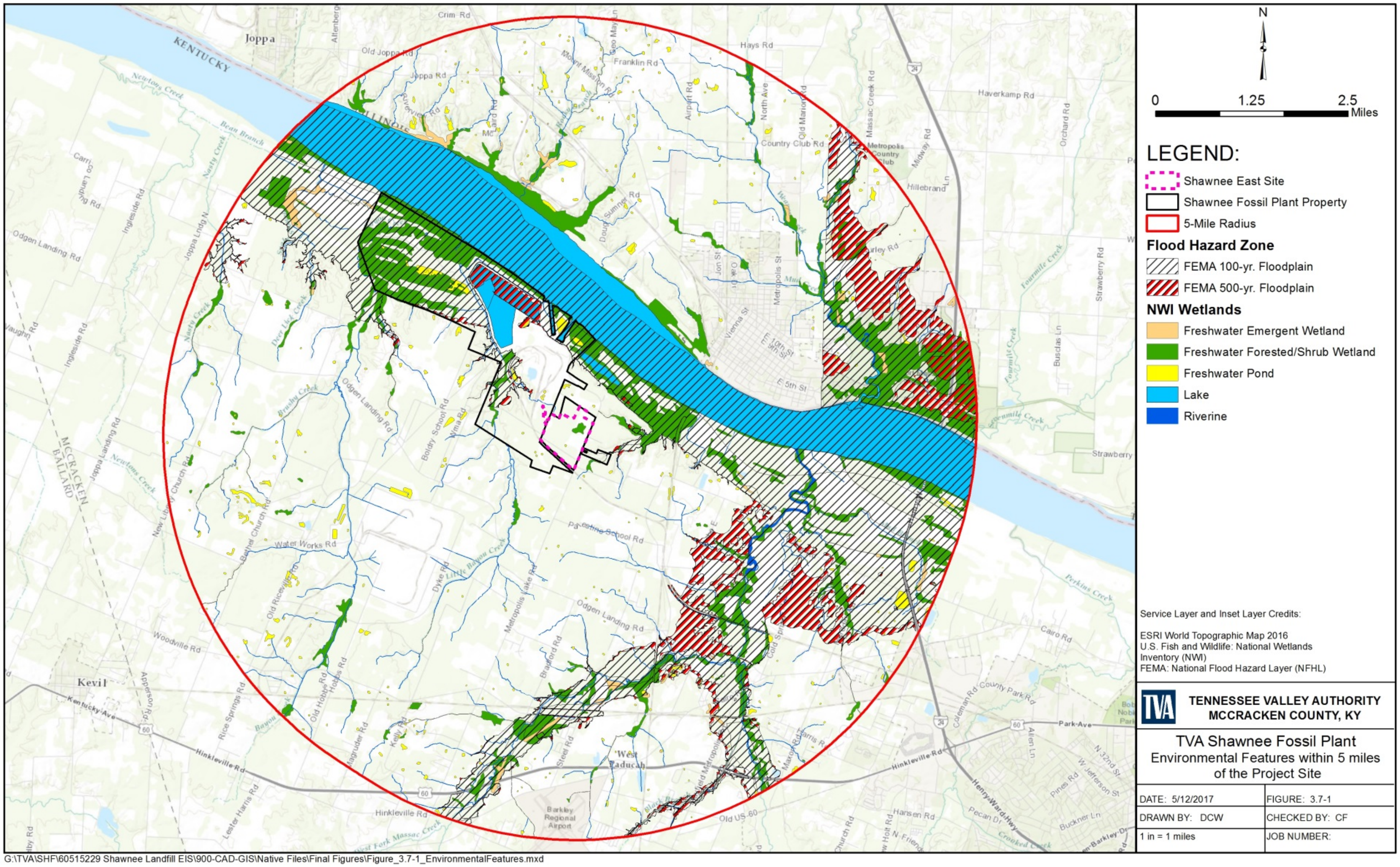


Figure 3.7-1. Environmental Features in the Vicinity of SHF

is adjacent to the plant site, is listed as impaired for fish consumption for both mercury in fish tissue and PCB in the water column from an unknown source (KDEP 2014). The Ohio River segment associated with mercury-related impairment is the reach from just below Louisville to approximately 0.5-mile upstream of the Wabash River mouth (ORM 772.35 to 843.1, just above the SHF site), or approximately 11 percent of the 664 miles of the Ohio River (KDEP 2013a). This stretch is well upstream of SHF.

A statewide fish consumption advisory is in effect for mercury, and long-standing fish consumption advisories remain in effect for the 7.2 miles of Little Bayou Creek. Little Bayou Creek is identified as not supporting warm water aquatic habitat due to pollutants including metals and radiation (KDEP 2013a). The suspected sources of the pollutants (especially the radiation) are industrial point sources and waste disposal from the former PGDP. A total maximum daily load (TMDL) limit was put in place for PCBs for this stream segment in 2001 (KDEP 2001).

The Kentucky Department for Environmental Protection, Division of Water, Water Quality Branch provided additional information regarding water quality for water resources in the vicinity of SHF. “Little Bayou Creek is impaired for the warm water aquatic life use due to beta particles and photon emitters, copper, gross alpha, cause unknown, lead and [PCBs]. Bayou Creek is impaired for the warm water aquatic life use due to beta particles and photon emitters, copper, gross alpha, lead, mercury, nutrient/eutrophication biological indicators, and sedimentation/siltation. Metropolis Lake, to the east of the project area is an exceptional and outstanding state resource water. The Ohio River, just downstream of the site, is an outstanding state resource water due to the presence of federal threatened and endangered species.” (Nalley 2017).

Although there are impairments in the watershed as listed above, TVA studies show that a balanced indigenous aquatic population exists in the Ohio River adjacent to SHF concurrent with existing plant operations and wastewater discharges to surface waters. Therefore, current operations do not appear to have had major negative impacts on surface water quality.

3.7.1.1 Shawnee East Site Water Features

Jurisdictional and non-jurisdictional streams and wetlands were delineated/characterized within the Shawnee East Site vicinity in October 2016 (AECOM 2016). The field survey of the Shawnee East Site documented surface water features that included nine ponds, two streams (total linear footage of 3,151.4) and two wet weather conveyances (total linear footage of 879.4) on the Shawnee East Site. A topographic map of the property also identifies an unnamed tributary of Little Bayou Creek that starts on the property and flows to the northwest. The USACE has performed a Jurisdictional Determination for the majority of the project area to determine wetlands and stream features that would require mitigation. All stream features noted in the project survey are located outside the Shawnee East Site, while two small ponds are within the proposed area of disturbance (Figure 3.7-1). Refer to Section 3.13 for a separate discussion of wetland resources. Stream flow data were not available for the unnamed streams. The current Shawnee East Site was historically utilized for agriculture or is undeveloped.

Drainage on the property generally flows to the northwest toward Little Bayou Creek. The southeastern survey area of the property (where the streams and wet weather conveyances are located) would drain to the northeast and ultimately discharge to the Ohio River through an unnamed tributary.

3.7.1.2 Existing SHF Wastewater Stream

SHF operates a surface water intake structure that withdraws an average of 543,019 million gallons per year, approximately 1487.72 million gallons per day (MGD), from the Ohio River for use as condenser cooling water (CCW) and plant process water (i.e., sluice water, fire protection, boiler feed water, safety eye wash and showers, and miscellaneous wash water). Approximately 98 percent of the water withdrawal is used for cooling, while approximately 2 percent is used for process water. The withdrawn water is returned to the river after appropriate treatment and is in compliance with SHF's KPDES permit.

There are several existing wastewater streams at SHF permitted under KPDES Permit Number KY0004219 (KDEP 2005): Outfall 002 (CCW); Outfall 004 (former chemical treatment impoundment that was closed in May 2016); and Outfall 001 (process and storm water discharges from the ash impoundment system). Potentially impacted onsite wastewater streams include the former SWL storm water discharge, CCW discharge channel, and ash impoundment discharge.

Because the ash impoundment discharge (Outfall 001) and the CCW discharge channel (Outfall 002) are the primary discharge points potentially affected by the proposed actions, they are the main focus of this discussion. About 25.75 MGD are discharged on average from the ash impoundment through Outfall 001. Outfall 001 discharges into the CCW discharge channel. The ash impoundment currently receives wastewater from a number of sources, as listed in Table 3.7-1.

The current SHF KPDES permit requires TVA to meet the ash impoundment effluent limits presented in Table 3.7-2. Existing KPDES permit limitations on the ash impoundment discharge are established for pH, oil and grease, total suspended solids, and acute toxicity. This permit also requires monitoring for hardness, flow, and reporting of 13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.

Approximately 1,490 MGD is discharged from the CCW discharge channel through KPDES Outfall 002. Outfall 002 discharges at ORM 946. The plant's permitted discharges from Outfall 002 are once-through CCW. The CCW itself should not be affected by the proposed project. However, because the ash impoundment (Outfall 001) discharges into the CCW discharge channel, Outfall 002 could be affected by this project by potential changes to Outfall 001. The current KPDES permit contains limitations on the CCW discharge for total residual chlorine and free available chlorine (no chlorine is added as part of normal operations), total residual oxidants and time of oxidant addition (no oxidants are added as part of normal operations), as well as thermal discharge (one million British Thermal Units per hour [MBTU/Hr]). The permit also requires reporting of flow, intake temperature, and discharge temperature.

Table 3.7-1. Sources and Quantities of Inflows to Ash Impoundment

Source	Average Annual Daily Inflow to Ash Impoundment (MGD)
Bottom ash sluice water	19.44
Coal yard drainage basin (receives effluent from the chemical treatment impoundment and station sumps)	5.7105
Inactive and active ash disposal areas, dry ash stacking areas, coal/ash dredge cell	0.4101
Limestone storage area and sump	0.0084
Air preheater washing wastes	0.0040
Pressure washing waste, water treatment plant waste	0.1501
Portable hand wash stations	0.0001
Precipitation	0.1709
Ash impoundment seepage discharged to effluent ditch	- 0.017
Evaporation	- 0.1226
Total	**25.7545**

Table 3.7-2. Outfall 001 Discharge Limitations and Requirements

Effluent Characteristics	Effluent Limitations				Monitoring Requirements	
	Monthly Average		Daily Maximum			
	Average Concentration (mg/L)	Average Amount (lb/day)	Average Concentration (mg/L)	Average Amount (lb/day)	Measurement Frequency	Sample Type
Flow	Report (MGD)		Report (MGD)		1/Week	Weir
pH	Range 6.0 – 9.0 (s.u.)				1/Week	Grab
Total Suspended Solids	30	--	75	--	1/Month	Grab
Oil and Grease	12	--	14	--	1/Month	Grab
Hardness (as mg/L of $CaCO_3$)	Report	--	Report	--	1/Quarter	Grab
Total Recoverable Metals	Report	--	Report	--	1/Quarter	Grab
Acute Toxicity*	N/A	--	1.00 TU_a	--	1/Quarter	2 Grabs

Source: KPDES Permit Number KY0004219 effective July 13, 2005
mg/L = milligrams per liter; lb/day = pounds per day; MGD = million gallons per day; s.u. = standard units; $CaCO_3$ = Calcium Carbonate
Total Recoverable Metals include: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc
*TU_a = acute toxicity unit; required quarterly.

3.7.1.3 Existing Coal Combustion Residuals Wastewater Treatment Facilities

SHF consumes an average of 2.7 million cubic yards of coal per year. SHF units produce on average 120,000 cubic yards of fly ash and 30,000 cubic yards of bottom ash per year (based on 2015 ash production), on a dry basis. The fly ash is pneumatically transported to a dry ash silo for temporary storage and the bottom ash is currently wet-sluiced to Ash Impoundment 2. A hydrated lime system for hydrogen chloride control injects hydrated lime into the flue gas, and any solid waste is captured in the baghouse with the fly ash and is stored in the former SWL. Operations adding a dry FGD system to Units 1 and 4 was initiated in October 2017, and a bottom ash dewatering system. All CCRs generated onsite are stored in the former SWL.

The CCR handling system at SHF includes Ash Impoundment 2; the coal yard drainage basin, which is pumped to Ash Impoundment 2; and the former SWL, which drains via storm water to Ash Impoundment 2. Ash Impoundment 2 discharges through Outfall 001.The maximum active area of exposed CCR in the former SWL is 10 acres. As stacking areas become inactive, they are stabilized with an interim cover, such as soil or bottom ash, for fugitive emission control, which is required on the unexposed or stabilized areas. The operational area within the former SWL is graded at the end of each day to limit ponding and encourage sheet flow runoff. Runoff from the former SWL is precipitation driven and flows to the Ash Impoundment 2.

3.7.2 Environmental Consequences

3.7.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not construct the proposed projects. Solid waste would continue to be placed in the former SWL and wastewaters would continue to be treated by Ash Impoundment 2 in accordance with the KPDES permit. Wastewater discharges would continue to comply with all applicable permit limits and, therefore, surface water quality adjacent to SHF should remain approximately the same. All BMPs and work practices would continue.

Because the proposed CCR Landfill would not be constructed, eventually the former SWL would reach capacity. This could have impacts associated with plant operations, but should not impact wastewater discharges. In general, a balanced indigenous aquatic population exists in the Ohio River adjacent to SHF concurrent with existing plant operations and wastewater discharges to surface waters. Therefore, current operations do not appear to have had major negative impacts on surface water quality. Thus, continued operations at SHF under the No Action Alternative would not be expected to cause any additional direct or indirect impacts to local surface water resources.

3.7.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

The Surface Water Technical Memorandum in Appendix H includes the results of TVA's analysis of the impacts associated with the implementation of the proposed actions. The following subsections summarize the results included in the memorandum.

3.7.2.2.1 Construction

Wastewaters generated during construction of the proposed projects may include construction-related storm water runoff; drainage from work areas, non-detergent equipment washings, and dust control; hydrostatic test discharges; and sanitary waste discharges.

Soil disturbances associated with construction activities can potentially result in adverse water quality impacts. Soil erosion and sedimentation can clog small streams and impact aquatic life.

TVA would comply with all appropriate state and federal permit requirements. A portion of the construction activities would be located on areas of the plant facility that already support heavy industrial uses. The eastern side of the Shawnee East Site has been used historically for agriculture. Appropriate BMPs would be followed, all proposed project activities would be conducted in a manner to ensure that waste materials are contained, and the introduction of pollutants to the receiving waters would be minimized and be in accordance with SWPPP limits. The Site BMP Plan, required by the KPDES permit, would be updated to include project-specific BMPs, or a stand-alone project BMP plan would be prepared. This plan would identify specific BMPs to address construction-related activities that would be adopted to minimize storm water impacts.

Additionally, impervious buildings and infrastructure prevent rain from percolating through the soil and result in additional runoff of water and pollutants into storm drains, ditches, and streams. Any existing infrastructure within the project limits of disturbance would be replaced with a proposed CCR Landfill, and capped impoundments, thus altering the current storm water flows. A portion of the project area is within an industrial site and is already partially covered with impervious structures or ground cover that decreases percolation. Construction would not significantly increase impervious surface area. The Shawnee East Site currently has little infrastructure or impervious cover; therefore, storm water flows would be altered substantially.

Storm water flow from the project areas would come primarily from runoff from the impoundment caps, the Process Water Basin(s), or the storm water/leachate collection system (LCS) from the Shawnee East Site. These flows would be properly treated with either implementation of proper BMPs or by diverting the storm water discharges to an appropriate storm water outfall or impoundment for co-treatment.

Equipment washing and dust control discharges would be handled in accordance with BMPs described in the BMP Plan required by the site's KPDES permit to minimize construction impacts to surface waters.

Onsite hydrostatic testing will have the option to use potable or surface waters and would be covered under the current KPDES permit.

Sanitary wastes generated during construction activities would be collected by the existing sewage treatment system, onsite septic system(s) or by means of portable toilets. These portable toilets would be located throughout construction areas and would be pumped out regularly, and the sewage would be transported by a vacuum truck to a publicly-owned wastewater treatment works that accepts pump out.

The approximately 205-acre Shawnee East Site would be used to provide borrow material for both the closure activities and for the proposed CCR Landfill. The potential borrow material has been evaluated to ensure that it can meet the required compaction requirements of the proposed designs and other specifications. The BMP Plan would cover any needed practices that would be required to ensure that no adverse impacts to surface water would be expected from the use of these borrow areas.

With the implementation of appropriate BMPs, only temporary, minor, impacts to surrounding surface waters would be expected from construction activities associated with impoundment/landfill closures and the use of the potential borrow areas.

Landfill construction activities could include, but are not limited to, the clearing and grading of the project site and grading of new separate storm water and leachate process water basin; the installation of the proposed CCR Landfill facility (including liner and leachate collection fields), and the installation of a forced main to pump leachate from the onsite leachate pond to the Process Water Basin(s). This proposed project would have similar temporary impacts during construction, as those noted previously in this section.

The proposed CCR Landfill project has the potential to impact the wetlands and streams identified on the proposed landfill property in the above mentioned wetland and stream characterization study (AECOM 2016). If these streams are deemed by the USACE to be jurisdictional, Kentucky Division of Water 401 Water Quality Certification and USACE 404 permits would be required which may require mitigation, such as onsite stream restoration or contributing to a stream mitigation bank, per permit requirements and/or availability.

3.7.2.2.2 Operation

<u>SHF Surface Water Withdrawal and Discharge Rates</u>

The main withdrawal usage plant-wide is for the CCW, which carries the majority (99.9 percent) of the thermal loading from SHF discharges through Outfall 002. The thermal discharge loading at Outfall 002 would not be changed by the current proposed projects. Thermal discharges from Outfall 001 would also not change. Raw, potable, and storm water flows associated with these projects would remain at ambient temperatures; therefore, no additional thermal impacts would be anticipated. No additional surface water withdrawals would be anticipated from the proposed projects. The closure of Ash Impoundment 2 and the former SWL and the addition of the proposed CCR Landfill would potentially change the waste stream configuration of some of the internal process and storm water waste streams on the plant site. However, the volumes of the process flows, except the contact storm water discharges from the former SWL, would not be expected to change with the implementation of the proposed projects under normal conditions. There would be storm water and leachate discharges that would be generated from the proposed CCR Landfill, which would be new flows. However, with the closure of the former SWL, the contact storm water discharges (storm water which comes in contact with CCR materials) would be expected to decrease significantly, and non-contact storm water would be expected to increase from this location onsite.

<u>Ash Impoundment and Former SWL Closures</u>

As identified in the PEIS (TVA 2016b), closure in place of Ash Impoundment 2 would minimize surface water flow to the impoundment, which would enhance stability of the berms due to a reduction of hydraulic inputs. As all work would be done in compliance with applicable regulations, permits, and BMPs; potential impacts of this alternative to surface water would be negligible. The main operational change that would take place with the closure of Ash

Impoundment 2 would be the change in management of the onsite storm water and process wastewater that is currently treated through this impoundment. CCR material in the northwest portion of Ash Impoundment 2 would be removed and hauled to the former SWL. A new perimeter dike would be constructed along the north and west boundary of the former SWL, and the remaining Ash Impoundment 2 dikes to the north would be removed along with any support structures. Once grading is complete, in-place closure of the former SWL would be performed. This work includes removing the cover soil on the former SWL followed by installation of a final soil or geomembrane cap system encompassing the entire area.

Portions of the Ash Impoundment 2 would be converted to Process Water Basin(s) where internal flows would be treated before being discharged to the CCW and ultimately to the Ohio River via Outfall 002. The Process Water Basin(s) would be designed and operated to ensure compliance with all CCR and KPDES regulations. Any discharges would comply with KPDES limits and KY Water Quality Standards to ensure in-stream water quality.

The existing outfall structures associated with Ash Impoundment 2 would either be utilized for wastewater discharge from the Process Water Basin(s) or would be removed and replaced with new ditches and/or outfall structures as needed to manage the storm water runoff from the closed impoundments and Solid Waste Landfill. Precipitation driven runoff should have much lower loadings of suspended solids, metals, and other constituents than current process wastewaters. Final drainage would be routed to existing or new discharge points and comply with the KPDES permit to ensure that no adverse impacts to surface waters would occur. Mitigation measures would be identified, as needed, to ensure the discharges meet permit limits. This may or may not require a permit modification. Additionally, all post construction contact storm water would be routed to the proposed Process Water Basin(s) or future wastewater treatment facility.

<u>CCR Landfill Operational Impacts</u>

CCR by-products that would be placed in the proposed CCR Landfill are expected to include fly ash, bottom ash, hydrated lime and dry scrubber waste (gypsum waste). By-product generation and characterization would be dependent on the coal source. The design coal for the proposed CCR Landfill would be based on the current CCR production utilizing 100 percent Powder River Basin blend. However the ammonia model was evaluated and considered a blend of 52/48 Power River Basin and Illinois Basin coal in the *Shawnee Fossil Plant Units 1 and 4 Final Environmental Assessment* (TVA 2014). This alternative coal blend was used for the evaluation of the ammonia model because, at the time of the above referenced Final Environmental Assessment, that coal was deemed to be the future worst case coal blend scenario. It is used again in this EIS because all future base information for ammonia in surface water is based on this coal blend; this worst case scenario bounds the future anticipated impacts.

The wastewater streams which could change substantively under this alternative are:

- The addition of the proposed CCR Landfill leachate stream and storm water runoff; and
- Non-contact surface runoff from the proposed CCR Landfill drainage area.

The average leachate flow from the proposed CCR Landfill was estimated to be approximately 0.0815 MGD, with a maximum peak flow of 0.968 MGD (Stantec 2016b). The storm water runoff, based on the design storm 24-hour and 100-year event, could be expected to have peak inflows of 155 MGD to each of the newly proposed storm water ponds that would be included as part of the design for the proposed CCR Landfill project. The outlet discharges of these ponds under the same conditions would be approximately 12.6 MGD per pond. An estimated daily flow of 0.129 MGD from both storm water impoundments has been approximated based on the current level of design. Storm water flows from the site would be discharged from the proposed ponds and would discharge through a newly constructed ditch line to a new storm water outfall to the Unnamed Tributary of Little Bayou Creek on the west of the Shawnee East Site. Little Bayou Creek and the unnamed tributary to Little Bayou Creek are zero-flow streams. Therefore, it was assumed that in-stream water quality standards would need to be met at the outfall (end of pipe) prior to mixing with the receiving stream, since there is no mixing with zero flow streams. Depending on the nature of this runoff, stream mitigation measures that may include wastewater treatment and/or rerouting of the waste streams, may be required prior to discharge to this stream. See the Metals Loading and Ammonia Criteria Evaluation below for details of potential discharge details.

Onsite Landfill Leachate and Runoff

The CCR solids not beneficially reused would be trucked and placed in the proposed CCR Landfill. The proposed CCR Landfill would have a liner system and a leachate collection system. The leachate would be discharged to a leachate pond and then would be pumped to the proposed Process Water Basin(s). The Process Water Basin(s) would discharge via existing Outfall 001 or a new outfall to the CCW and ultimately through Outfall 002 to the Ohio River. Ammonia concentrations in the landfilled materials would be dependent on SCR process and plant specifics. If it is necessary to limit in-stream loading of landfill leachate, several studies by TVA have been conducted at SHF which would inform the process (TVA 2014, TVA 2017)

The leachate stream would be discharged to leachate pond and then pumped to the new Process Water Basin(s) for treatment. The effluent from the basin(s) could then discharge through either Outfall 001 or a new outfall to the CCW and ultimately would be discharged through Outfall 002. These flows have the potential to be a higher concentration, low flow stream, alkaline in nature, with some detectable metals and ammonia levels. All waste streams would comply with KPDES permit limits and regulations. The leachate would be treated as required to meet all applicable KPDES permit requirements and in-stream water quality standards. Therefore, potential impacts to surface water under this alternative would be minor. Should the option be chosen to transport this by-product to an offsite landfill, this waste stream would be blended with leachate from other materials landfilled at that site and treated as necessary to comply with the offsite facility's permits.

Metals Loading and Ammonia Criteria Evaluation

The concentrations of metals in the Ohio River after receiving discharges from the former SWL were evaluated in the *Shawnee Fossil Plant Units 1 and 4 Environmental Assessment* (TVA 2014). The assessment evaluated conditions after the installation of a proposed dry flue gas desulfurization process and selective catalytic reduction technology on Units 1 and 4, which are currently being constructed. That assessment was utilized and expanded upon for this evaluation of the proposed CCR Landfill. Additional details of the metals loading evaluations are located in the SHF CCR EIS Technical Memorandum (TVA 2017). The evaluation of the proposed CCR Landfill showed that added loadings from the by-product leachate collection system discharge would be unlikely to increase the metals concentrations in the Ohio River. Additionally, the concentrations would not exceed KPDES water quality standards for the constituents evaluated. This analysis is based on conservative estimates of maximum discharges from this site because the leachate flow used would be the peak flow during the last stage of operation of the proposed CCR Landfill combined with the low 7Q10 river flow of the Ohio River. Additionally, this loading and mixing calculation did not take into account any treatment in the Process Water Basin(s).

Evaluation for the storm water loading from the proposed CCR Landfill indicates the potential for increases in metals and ammonia concentrations in the unnamed tributary to Little Bayou Creek. A loading calculation was performed utilizing preliminary storm water flow data. The peak flow data from the 100 year, 24-hour storm were used. Flows going into each storm water pond were estimated, and the concentrations coming out of each storm water pond were calculated. Additionally, this loading and mixing calculation did not take into account any treatment in the storm water ponds. Because the receiving stream is a zero flow stream, it was assumed that in-stream water quality standards would need to be met at the storm water outfall prior to mixing with the stream. The evaluation showed that all constituents evaluated would be below water quality standards except for selenium and thallium. An ammonia model was used to evaluate the maximum future ammonia releases from the former SWL as part of the *Shawnee Fossil Plant Units 1 and 4 Environmental Assessment* (TVA 2014). The model was based on extremely conservative assumptions regarding the amount of ammonia entering the river, the volume of ammoniated water released, and the flow of the river at the time of release. The current SHF KPDES permit requirements for the Outfall 001 discharge do not include limitations for ammonia concentrations; however, limits for acute toxicity are included and there are existing water quality criteria for ammonia. This model was adapted to account for the difference in the flows from the proposed CCR Landfill and this wastewater stream was evaluated without intermediate pond treatment; that is, with no treatment from the current Ash Impoundment 2 or the proposed future Process Water Basin(s). The concentrations of total ammonia (as nitrogen) were found to be below both the chronic and acute toxicity levels when the ammonia on ash was at its theoretical peaks as established in the *Shawnee Fossil Plant Units 1 and 4 Environmental Assessment*. These peaks were when the ammonia-on-ash concentrations were at 266 milligrams (mg) nitrate-nitrogen per kilogram (NH_3-N/kg) (combined ash mixing concentration would be 99.4 mg NH_3-N/kg) during winter months and 434 mg NH_3-N/kg (combined ash mixing concentration would be 161.94 mg NH_3-N/kg) during summer months (TVA 2014, TVA 2017).

Ammonia was also evaluated in the storm water runoff from the proposed CCR Landfill. This runoff may be discharged via a new storm water outfall to the unnamed tributary to Little Bayou Creek. Flows going into each storm water pond were estimated, and the concentration coming out of each storm water pond was calculated. This loading and mixing calculation did not take into account any treatment in the storm water ponds. Because the receiving stream is a zero flow stream, it was assumed that in-stream water quality standards would need to be met at the storm water outfall prior to mixing with the stream. The concentrations of total ammonia (as nitrogen) were found to below both the chronic and acute toxicity levels when the ammonia on ash was at its theoretical peaks as established in the TVA SHF Unit 1 and Unit 4 EA.

After accounting for the impacts of the by-product storage leachate, the impacts after mixing with the Ohio River would be minor. However, there would be a potential for impacts from selenium and thallium in the unnamed tributary to Little Bayou Creek. TVA would conduct a characterization of the leachate and runoff to streams to confirm no significant impacts to the Ohio River or the unnamed tributary to Little Bayou Creek. The waters would be analyzed for metals and other parameters. If determined to be necessary, appropriate mitigation measures, which could include the rerouting of this waste stream to either the proposed Process Water Basin(s) or directly to the Ohio River, would be evaluated and implemented to ensure that the discharge KPDES permit requirements for the water quality parameters are met.

Summary - Environmental Consequences of Alternative B

Direct and indirect impacts to surface water associated with the implementation of Alternative B are summarized in Table 3.7-3.

Table 3.7-3. Summary of Impacts to Surface Water – Alternative B

Project	Impact	Severity
Former SWL Closure	Closure activities	With the implementation of appropriate BMPs, only temporary, minor impacts to surrounding surface waters would be expected. Impacts to surface water features onsite would be mitigated as a result of adherence to permit requirements.
	Operations Impacts	The Process Water Basin(s) would be used to manage onsite storm water and process water flows. All discharges would comply with current or potential KPDES permit measures and other state and federal regulations. Therefore, no impact to surrounding surface waters would be expected.
Ash Impoundment 2 Closure	Closure activities	With the implementation of appropriate BMPs only temporary minor, impacts to surrounding surface waters would be expected. Impacts to surface water features onsite would be mitigated as a result of adherence to permit requirements.
	Operations Impacts	The Process Water Basin(s) would be used to manage onsite storm water and process water flows including landfill leachate. All discharges would comply with current or potential KPDES permit measures and other state and federal regulations. Therefore, no impact to surrounding surface waters would be expected.
Proposed CCR Landfill	Construction Impacts	Minor temporary impacts due to runoff would be minimized through BMPs.
	Operations Impacts	Minor impacts to Ohio River from leachate. Mitigation would be implemented to meet permit requirements if required. Storm water runoff would be expected to meet instream water quality standards at outfall prior to mixing with the unnamed tributary of Little Bayou Creek. Wastewater treatment to reduce solid forms of metals, etc., or rerouting of the waste stream may be required to mitigate impacts of discharges to the unnamed tributary.

3.7.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Under this alternative, impacts associated with closure of Ash Impoundment 2 and the former SWL would be the same as identified under Alternative B. CCR produced by SHF would be transported to an existing offsite permitted landfill. It is assumed that permits would be in place that would be protective of water quality. Because this is an existing permitted landfill, it is assumed that this landfill would be lined and would comply with all solid waste regulations. Therefore, when BMPs are utilized, there would be no changes from the existing environment within the landfill boundaries under this alternative.

3.8 Floodplains

3.8.1 Affected Environment

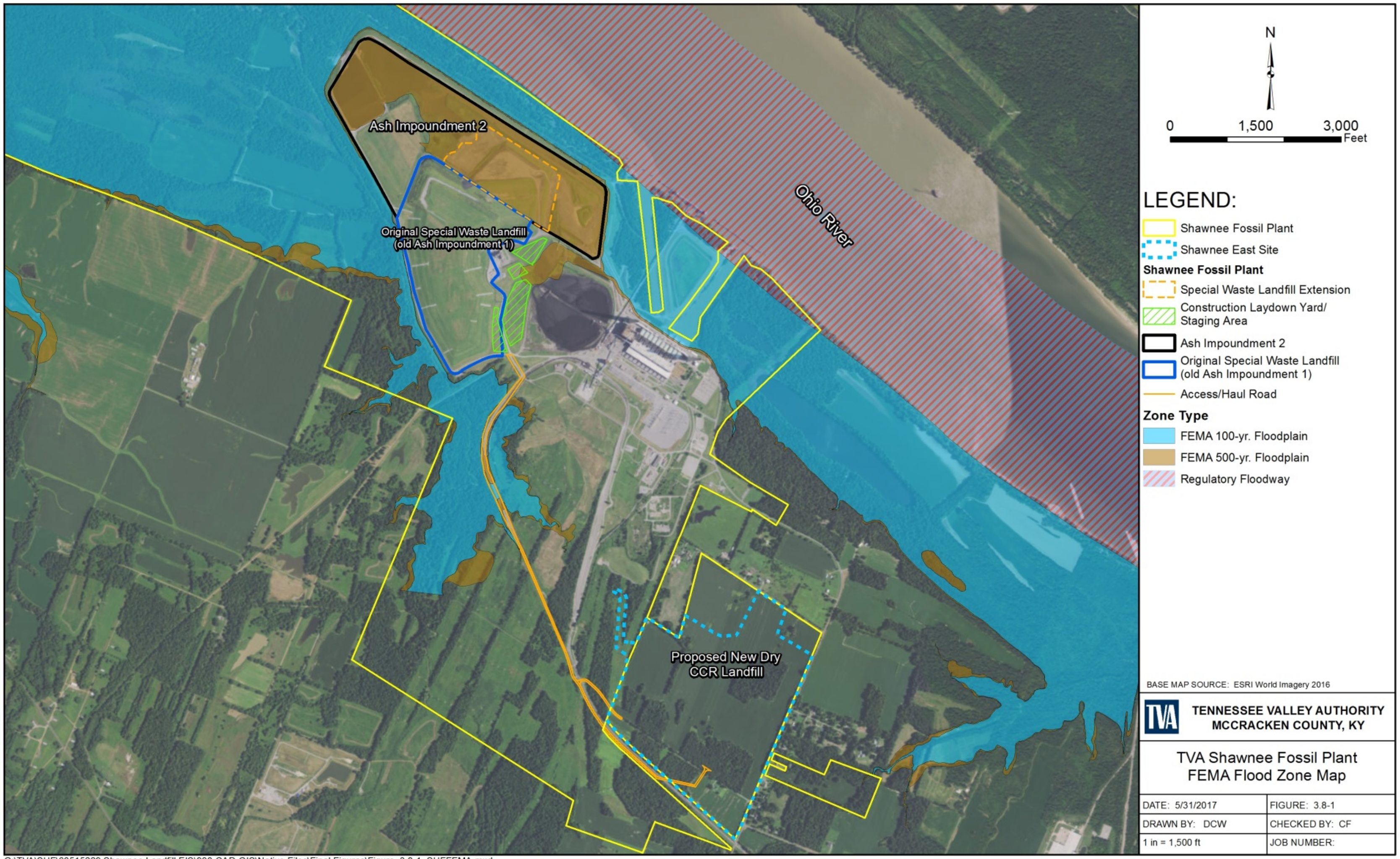
A floodplain is the relatively level land area along a stream or river that is subjected to periodic flooding. The area subject to a 1.0 percent chance of flooding in any given year is defined as the 100-year floodplain. The area subject to a 0.2 percent chance of flooding in any given year is defined as the 500-year floodplain.

The SHF is located along the left descending bank of the Ohio River at approximately ORM 944.5 to 947.5. The proposed CCR Landfill would be located on the Shawnee East Site, (just to the southeast of SHF) approximately 3,000 feet from the river bank and would be separated from the river by rural residential land. The National Flood Insurance Program Flood Insurance Study and associated Flood Insurance Rate Map are available for the Ohio River at this location (Figure 3.8-1). The Ohio River 100-year flood elevation at the proposed project area ranges from 336 feet on the northwest side of the property to 336.94 feet on the southeast side; and the 500-year flood elevation would be approximately 340 feet. Elevations are referenced to North American Vertical Datum 88 (NAVD88) (Federal Emergency Management Agency [FEMA] 2011). The Ohio River flood elevations as shown on Profile 32P and 33P of the 2011 McCracken County, Kentucky, Flood Insurance Study (FEMA 2011) are listed in Table 3.8-1.

Table 3.8-1. Selected Ohio River Flood Elevations

Return Period (years)	Elevation at ORM 944/Railroad (feet, NAVD88)	Elevation at ORM 946/Low Crest Elevation of SHF Perimeter Dike (feet, NAVD88)	Elevation at ORM 948/Little Bayou Creek (feet, NAVD88)
10	328.0	328.0	328.0
50	334.5	334.5	334.0
100	337.0	336.5	336.3
500	340.0	339.5	339.0

A perimeter dike is in place on the SHF facility adjacent to the Ohio River. Based on topographic data developed by TVA, the lowest crest elevation of the perimeter dike is at about elevation 349 feet, which is at least 3 feet higher than the Ohio River 500-year flood elevation. The entire SHF facility is located behind the perimeter dike.



G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Final Figures\Figure_3.8-1_SHFFEMA.mxd

Figure 3.8-1. Floodplains at SHF

3.8.2 Environmental Consequences

As a federal agency, TVA is subject 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 impacts 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. The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative. For certain "critical actions," the minimum floodplain of concern is the 500-year floodplain, which is the area subject to inundation from a 500-year (0.2 percent annual chance) flood.

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, hospitals, or emergency operations centers). CCR material could enter floodplains and streams and alter the flood-carrying capacity of those streams, and thus create an added dimension to a disaster." Therefore, the proposed action would be considered a "critical action."

3.8.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and at its former SWL and Ash Impoundment 2 and would not close either of those facilities. Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF, or haul CCR to an existing permitted landfill. As there would be no changes to floodplains associated with project actions, there would be no impacts to the floodplain under the No-Action Alternative.

3.8.2.2 Alternative B – Construction of Onsite CCR Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

Under Alternative B, TVA would close Ash Impoundment 2 through closure-in-place by reduced footprint, close its former SWL through closure-in-place, and construct and operate the proposed CCR Landfill onsite at SHF. The closure activities would have no impact on floodplains as all actions would occur outside of floodplains.

The proposed CCR Landfill would be located on the Shawnee East Site, southeast of the SHF facility, at approximately ORM 944.5 to 945.5. The entire approximately 205 acre Shawnee East Site is at an elevation greater than 340 feet and is not within the 100- or 500-year floodplains as shown in Figure 3.8-1, which would be consistent with EO 11988.

No project activities would occur within or would disturb 100- or 500-year floodplains; therefore, Alternative B would have no impact on floodplains.

The proposed CCR Landfill, and closure of the former SWL and Ash Impoundment 2, would have no significant impact on floodplains, which would be consistent with EO 11988. TVA would notify the Kentucky Division of Water and provide them an opportunity to review and comment on the proposed actions.

3.8.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

The closure of the former SWL and Ash Impoundment 2 under Alternative C would be the same as that described under Alternative B. The Shawnee East Site would be used for borrow material for the closure actions. TVA would utilize an existing, permitted offsite landfill for the disposal of the dry ash. The impacts on floodplains would be the same under Alternative C as for Alternative B with regard to the closure of Ash Impoundment 2 and the former SWL. Additionally, as the offsite landfill is an existing permitted facility, there would be no additional impacts to floodplains associated with the offsite disposal of CCR. Therefore, there would be no impacts to floodplains under Alternative C, which would be consistent with EO 11988. As with Alternative B, TVA would notify the Kentucky Division of Water and provide them an opportunity to review and comment on the proposed actions.

3.9 Vegetation

3.9.1 Affected Environment

SHF is located within the Wabash-Ohio Bottomlands Level IV ecoregion (Woods et al. 2002). This unglaciated, level floodplain along the Ohio River was historically southern floodplain forest, a mix of oaks, cypress, and hardwood species. This region has been largely drained and converted for commercial and agricultural use. SHF is mostly an intensely developed site that has been heavily disturbed by the construction, maintenance, and operation of the facility. As a result of this alteration of the physical landscape, most areas within SHF no longer support a natural plant community. Land use within the project area is classified as developed, low intensity, and the area contains vegetation typical of disturbed or landscaped areas. The Shawnee East Site includes former agricultural land and a number of areas of deciduous forest that are surrounded by fields or located along property lines.

Land use and land cover on SHF and in the vicinity are described in Section 3.3. Land use in the vicinity consists of agricultural, residential, rural, and commercial activities (TVA 2016d). Vegetation land cover within 5 miles of the project area is primarily cultivated crops, deciduous forest, and pasture. The surrounding region also contains small amounts of woody wetlands, evergreen forests, grassland, and shrub/scrub land. To the southwest and south of SHF and the Shawnee East Site is the Western Kentucky Wildlife Management Area (WKWMA), which occupies over 6,000 acres of primarily forested land.

Field surveys were conducted in October and November 2016 to evaluate land cover, threatened and endangered species, and plant community composition on SHF and within the Shawnee East Site. The Ash Impoundment 2/former SWL area is previously developed, industrial land consisting mainly of ash impoundments and landfill. The agricultural or undeveloped Shawnee East Site encompasses three distinct vegetation communities: forested wetlands, dry upland woodlands, and old fields (abandoned farmland undergoing ecological succession). A detailed description of the vegetation within each of these community types is provided in the Vegetation Field Survey Report (Appendix B). Some of the areas of old-field community also include wetlands, and a number of small ponds are located in each of these communities. The ponds appear to have been constructed as former livestock watering ponds and are generally very shallow and lack aquatic life other than amphibians and invertebrates. Emergent vegetation was not noted in the ponds, indicating that they often go dry. Duck weed was observed in a few of these ponds.

Old-field communities on the Shawnee East Site are mainly composed of heavily disturbed former cropland. Much of this land historically was agricultural fields, which currently support mainly early successional herbaceous species and also include wetland depressions. As shown in aerial imagery, these old fields had been used for crop production in 2015, and in 2016 visual observation confirmed most contained corn stubble. Currently, the fields are bush-hogged to control weeds and grasses. Saplings becoming established in the old fields are species of some of the more common trees in the area, including sycamore, cottonwood, yellow-poplar, and sweet-gum. Five old-field communities were surveyed within the Shawnee East Site (see Appendix B figures). Three old fields are located on a 110-acre parcel south of Anderson Road on the south side of the railroad tracks, and one is located on a 30-acre tract of land on the east side of Metropolis Lake Road. The largest old-field community is an approximately 200-acre area north of Anderson Road that covers most of the proposed area of disturbance for the landfill. This area consists of multiple parcels of former cropland and includes wetland depressions. This area north of Anderson Road is the only old-field community that would be disturbed by construction of the proposed CCR Landfill.

Forested wetland communities on the Shawnee East Site are dominated by red maple (*Acer rubrum*), green ash, river birch, and American elm. Forested wetlands were observed on the northern side of the 30-acre tract east of Metropolis Lake Road, in abundance on the 110-acre area south of Anderson Road, and as scattered isolated areas or adjacent to wetland depressions in the 200-acre tract north of Anderson Road.

Dry upland, woodland communities on the Shawnee East Site consist of deciduous oak-hickory forests. Southern red oak, post oak, white oak, shagbark hickory, and mockernut hickory were the most abundant tree species. The understory had minimal herbaceous species and few shrubs, with small patches invaded by Japanese grass, Chinese privet, and bittersweet vine.

3.9.1.1 Invasive Species

EO 13751 (Invasive Species), as amended, calls upon executive departments and agencies to take steps to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. TVA implements the executive order, to the extent practicable, through BMPs. For example, TVA has developed lists of non-native plant species that are non-invasive and can be used for erosion control and other situations (Muncy 2012), thereby minimizing the spread of invasive species in disturbed areas.

Most lands in and around the TVA power service area have been affected by introduced, non-native plant species. According to NatureServe (2016), invasive, non-native species are the second leading threat to imperiled native species. Invasive plant species erode forest productivity and degrade diversity of wildlife habitat. Some have been introduced into this country accidentally, but most were brought here as ornamentals or for livestock forage. These exotic plants arrived without their natural predators of insects and diseases that tend to keep native plants in natural balance. As a result, invasive species are able to out-compete native vegetation for available resources, such as nutrients, space, and water.

Invasive plant species are most abundant in the dry upland, woodland areas of the Shawnee East Site. The most common species are Japanese stiltgrass, Chinese privet and bittersweet vine. These species tended to associate with dry, open, woodland communities, but were found in other vegetation communities as well, such as in moist woodlands and near wetlands. Total cover of Chinese privet was approximately 10 percent across the entire Shawnee East Site. Cover of Japanese stiltgrass was also approximately 20 percent. Johnson grass was another invasive species commonly seen occupying the edges of dry woodland areas, and it was common in old fields. Total coverage of Johnson grass in old fields ranged between about 10 and 25 percent. Other invasive species observed included bittersweet vine, multiflora rose, common periwinkle, autumn olive, phragmites, and giant reed. These species are sparsely distributed throughout the Shawnee East Site.

3.9.2 Environmental Consequences

3.9.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and would not cease operations at or close its former SWL and Ash Impoundment 2. Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF, or haul CCR to an existing permitted landfill. No closure activities (i.e., cover system construction) would occur under the No Action Alternative. The impoundments would continue to receive the storm water and other process wastewaters that they currently receive. The proposed CCR Landfill would not be constructed and there would be no impact to vegetation. Because there would be no changes from the current conditions, there would be no significant direct or indirect impacts to vegetation under Alternative A.

3.9.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Under Alternative B, TVA would close Ash Impoundment 2 through closure-in-place by reduced footprint, close its former SWL in-place, and construct and operate the proposed CCR Landfill on the Shawnee East Site at SHF. The plant communities on the Shawnee East Site include old field, forested wetlands, and upland woodlands.

Alternative B would result in the clearing of vegetation from approximately 205 acres of land on the Shawnee East Site. This land consists of approximately 135 acres of old field, 64 acres of upland woods, and 5.5 acres of forested wetland. All of these vegetation communities are common in the adjacent WKWMA and in the region. The acreage of vegetation that would be lost in constructing the landfill would be minor in comparison to the extensive areas in which these vegetation types occur elsewhere in the vicinity. The areas to be directly impacted by clearing for the proposed CCR Landfill are predominantly former agricultural fields that have been intensively altered until recently. These old-field communities do not represent unique or valuable vegetation resources. Similar vegetation and land use are readily available in the vicinity and in the region.

Alternative B includes revegetation as part of the cover system for both the closure of Ash Impoundment 2 and the former SWL, and for the proposed CCR Landfill as it is filled. Placement of fill material and the establishment of vegetation will result in a shift in cover at Ash Impoundment 2 and the former SWL from its current condition to a turf grass community. A similar shift would occur at the Shawnee East Site as the landfill is filled.

Construction activities associated with the closure of Ash Impoundment 2 and the former SWL may also result in the introduction and/or spread of invasive plant species from borrow material and heavy equipment. However, the generalized transformation of the Ash Impoundment 2 impoundment and the former SWL from a highly disturbed environment to a stable, controlled, and vegetated landscape likely would reduce the potential for invasive species to become established. Additionally, TVA BMPs for erosion control and use of native and/or non-invasive species would promote the rapid establishment of desirable vegetation and further minimize invasive plant impacts.

Overall, direct and indirect impacts on vegetation under Alternative B would be minor.

3.9.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

The closure of the former SWL and Ash Impoundment 2 would be the same under Alternative C as described previously for Alternative B. Under Alternative C, TVA would utilize an existing permitted offsite landfill where dry CCR would be transported and disposed. The proposed CCR Landfill would not be constructed on SHF property. As under Alternative B, soil from the Shawnee East Site would be removed under Alternative C and transported to the SHF facility for use as borrow material in the closure of Ash Impoundment 2 and the former SWL. The removal of this borrow material would result in the clearing of vegetation from parts of the proposed area of disturbance within the landfill property. The effects on vegetation would be similar to those discussed for Alternative B, although the areas potentially affected would be smaller. Because the offsite landfill is already in operation and permitted, no significant impacts to vegetation would be anticipated at that site as a result of this alternative. Therefore, the impacts on vegetation associated with Alternative C would be minor and smaller than the impacts under Alternative B.

3.10 Wildlife

3.10.1 Affected Environment

The potentially affected environment at the SHF is located along the Ohio River and includes approximately 496 acres of Ash Impoundment 2 and the former SWL within the SHF facility and approximately 205 acres on the Shawnee East Site. Potential wildlife habitat in this area of the facility includes mowed fescue lawn and the vegetated side slopes of the current landfill, which are primarily covered in common reed and contain no trees or woody shrubs. The surrounding area includes the coal stockpile and other plant facilities to the east, forested and agricultural areas to the west and south, and wooded riparian area of the Ohio River to the north. These areas would not be disturbed by the proposed actions. Aquatic habitats adjoining the 496-acre SHF project area include the Ohio River to the north and Little Bayou Creek to the west and south. An early successional, hardwood-forested area is located near the proposed Process Water Basin(s) on the river side of the perimeter dike that surrounds the existing ash management area. Neither this forested habitat nor any riparian or aquatic habitat along the Ohio River or Little Bayou Creek would be impacted by the proposed action or alternatives.

Mowed fields of grass and other herbaceous vegetation in the area of the former SWL and the bottom ash trench can be used by many common wildlife species. Birds that may utilize these grassy areas include the Canada goose, eastern meadowlark, grasshopper sparrow, killdeer, European starling, and red-tailed hawk (Palmer-Ball 1996, National Geographic Society 2002). Small mammals that may inhabit these grassy areas include the eastern cottontail, eastern mole, deer mouse, prairie vole, southeastern shrew, and eastern chipmunk. Small patches of disturbed forest adjacent to the industrialized areas of SHF are often used by the American crow, American robin, American goldfinch, blue jay, eastern towhee, northern cardinal, northern mockingbird, red-winged blackbird, red-shouldered hawk, and wild turkey (National Geographic Society 2002).

The WKWMA is included within the northwest to south portions of the SHF property and extends off the SHF to the south approximately 3 miles. The WKWMA occupies 6,425 acres and includes old fields, woodlots, grasslands, crop fields, and food plots as well as 12 fishing ponds (Kentucky Department of Fish and Wildlife Resources [KDFWR] 2016a). The WKWMA is considered a birding hotspot, with 138 species recorded in the area (eBird 2013). Mist netting in the WKWMA has identified the presence of the eastern red bat, little brown bat, and tricolored bat. It is likely that the big brown bat, hoary bat, and silver-haired bat would also occur in the vicinity (DOE 2015). White-tailed deer tracks were observed within the SHF facilities area during a site visit in October 2016. Other mammals likely to inhabit the vicinity of SHF and the WKWMA include the striped skunk, Virginia opossum, raccoon, red fox, gray fox, coyote, bobcat, woodchuck, beaver, muskrat, and mink. The WKWMA is not within any of the proposed project action areas.

Birds that may utilize the aquatic habitats provided by the slow or standing water of the bottom ash trench and the bottom ash impoundment include the Canada goose, double-crested cormorant, great blue heron, green heron, mallard, and other duck species (Palmer-Ball 1996, TVA 2016b). Shorebirds such as the killdeer, semipalmated plover, lesser yellowlegs, and pectoral sandpiper may utilize these ash impoundments as stop-over habitats during migration.

Common amphibian and reptile species that use similarly disturbed, wet areas include the American toad, Fowler’s toad, green frog, spring peeper, upland chorus frog, common snapping turtle, and red-eared slider (DOE 2015, TVA 2016b).

The approximately 205-acre Shawnee East Site is much less disturbed than the Ash Impoundment 2 and former SWL area, and provides far more diverse habitats than the industrial area of SHF. The Shawnee East Site includes large areas of former cropland, old fields, fragmented tracts of upland forest, and numerous small wetland areas, small ponds, and drainages (as described in Section 3.13). The Shawnee East Site is primarily former cropland that is mowed (bush-hogged) and was last planted in crops in 2015. Former cropland occupies approximately 75 percent of the Shawnee East Site and, based on recent cultivation and mowing, does not provide permanent habitat for many wildlife species. The site also encompasses approximately 68 acres of woodland, including areas of up to 15 acres in size, as well as smaller wooded areas and isolated trees.

The Shawnee East Site supports an abundant and diverse wildlife community, and many of the species identified above for the SHF facility area are also found there. In addition, white-tailed deer and wild turkeys are abundant. Other bird species observed or considered likely to be present based on the October and November 2016 field surveys include the pileated woodpecker, downy woodpecker, white-breasted nuthatch, northern flicker, eastern phoebe, tufted titmouse, Carolina chickadee, indigo bunting, wood thrush, great horned owl, and screech owl. A number of frog and salamander species were detected in the small ponds within the Shawnee East Site.

As of October 2016, the TVA Regional Natural Heritage database included no records of caves within 5 miles of the project area, and none was found on the project site in October 2016. One large colony of great blue herons has been reported approximately 3.7 miles east of SHF. No additional heron rookeries, osprey nests, or aggregations of other migratory birds were observed within the project area, and none is recorded within 5 miles of SHF.

A listing of migratory birds that might be affected by the project was obtained by querying the USFWS Information for Planning and Conservation (IPaC) website (USFWS 2016a). A total of 22 species of migratory birds considered by USFWS to be of conservation concern were identified in the IPaC search as having the potential to occur in the area of SHF and be affected by activities there (Table 3.10-1). The habitat preferences and seasonal occurrence of the birds of conservation concern identified by the IPaC search are provided in Table 3.10-1. The table also provides an indication of whether habitats in the project area potentially may satisfy the habitat preferences of each species. Those species for which preferred habitat is available have a potential to occur in the project area during the seasons indicated.

Table 3.10-1. Migratory Birds Identified by the IPaC Trust Resources Report[1] as Birds of Conservation Concern for the SHF Area

Common Name	Scientific Name	Season of Occurrence	Habitat[1]	Potential Habitat in Project Area?
Bald eagle	*Haliaeetus leucocephalus*	Year-round	Near medium to large rivers, lakes and reservoirs, with available food sources, mainly fish, and surrounding forests.	No

Table 3.10-1. Migratory Birds Identified by the IPaC Trust Resources Report[1] as Birds of Conservation Concern for the SHF Area

Common Name	Scientific Name	Season of Occurrence	Habitat[1]	Potential Habitat in Project Area?
Bell's vireo	*Vireo bellii*	Breeding	Dense brush, willow thickets, streamside thickets, often near water, also adjoining uplands; nests in shrubs or low trees.	Yes
Bewick's wren	*Thryomanes bewickii ssp. bewickii*	Breeding	Uses brushy areas, thickets and scrub in open country, open and riparian woodland. In eastern North America, generally occurs at higher elevations of the Appalachians in farmyards, brushy places, openings and edges of woodlands, and overgrown fields. Typically nests in natural tree cavities or among crannies formed by exposed roots. May use small cavities in human-made objects including fence posts, buildings, or bird houses.	Yes
Chuck-wills-widow	*Caprimulgus carolinensis*	Breeding	Deciduous forest, pine-oak association, live-oak groves, and edges of clearings. Dry or mesic woods and forests with either pine or hardwood, forages over fields and clearings.	Yes
Dickcissel	*Spiza americana*	Breeding	Grassland, meadows, savanna, cultivated lands, brushy fields. Nests on ground in grass or rank herbage, or raised a little above ground, in grass tufts or tall weeds, or in low shrubs or trees.	Yes
Fox sparrow	*Passerella iliaca*	Wintering	Dense thickets in coniferous or mixed woodlands, parks, and gardens, wooded bottomlands along rivers and creeks.	Yes
Henslow's sparrow	*Ammodramus henslowii*	Breeding	Open fields and meadows with grass interspersed with weeds or shrubby vegetation, especially in damp or low-lying areas. Uses unmowed hayfields (abandoned if cut). Found in a variety of habitats that contain tall, dense grass and herbaceous vegetation.	Yes

Table 3.10-1. Migratory Birds Identified by the IPaC Trust Resources Report[1] as Birds of Conservation Concern for the SHF Area

Common Name	Scientific Name	Season of Occurrence	Habitat[1]	Potential Habitat in Project Area?
Kentucky warbler	*Oporornis formosus*	Breeding	Humid deciduous forest, dense second growth, swamps. Prefers forests with a slightly open canopy, dense understory, and well-developed ground cover.	Yes
Le Conte's sparrow	*Ammodramus leconteii*	Wintering	Variety of old field and prairie habitats with dense cover of grass or sedge including moist fields of broomsedge, rice stubble, airfield grasslands, and damp weedy or grassy fields.	Yes
Least bittern	*Ixobrychus exilis*	Breeding	Tall emergent vegetation in marshes, primarily freshwater.	No
Loggerhead shrike	*Lanius ludovicianus*	Year-round	Open country with scattered trees and shrubs, and, occasionally, open woodland; often perches on poles, wires or fencepost. During periods of cold with snow cover, sometimes moves into woodlots. In winter may move from pastures to shrub and open forest habitats during periods of cold, wet weather.	Yes
Mississippi kite	*Ictinia mississippiensis*	Breeding	Tall forest, open woodland, prairie, semiarid rangeland, shelterbelts, wooded areas bordering lakes and streams in more open regions, and lowland/floodplain forests. Requires open areas near nesting sites for foraging.	Yes
Prairie warbler	*Dendroica discolor*	Breeding	Brushy second growth, dry scrub, low pine-juniper, pine barrens, burned-over areas, sproutlands.	No
Prothonotary warbler	*Protonotaria citrea*	Breeding	Mature deciduous floodplain, river, and swamp forests; wet lowland forest. Primary habitats are almost always near standing water; swamps that are somewhat open with scattered dead stumps are preferred.	No

Table 3.10-1. Migratory Birds Identified by the IPaC Trust Resources Report[1] as Birds of Conservation Concern for the SHF Area

Common Name	Scientific Name	Season of Occurrence	Habitat[1]	Potential Habitat in Project Area?
Red-headed woodpecker	*Melanerpes erythrocephalus*	Year-round	Open woodland, especially with beech or oak, open situations with scattered trees, parks, cultivated areas and gardens. Nests in holes excavated 2-25 meters above ground by both sexes in live tree, dead snag, utility pole, or fencepost. Sometimes uses existing holes in poles or posts.	Yes
Rusty blackbird	*Euphagus carolinus*	Wintering	During migration and winter, habitat is primarily wooded wetlands and riparian areas but also includes various open woodlands, scrub, pastures, and cultivated lands.	Yes
Sedge wren	*Cistothorus platensis*	Migrating	Grasslands and savanna, especially where wet or boggy; sedge marshes; moist meadows with scattered low bushes; upland margins of ponds and marshes; locally in dry cultivated grain fields. In migration and winter also in brushy grasslands.	Yes
Short-eared owl	*Asio flammeus*	Wintering	Broad expanses of open land with low vegetation for foraging are required. Habitat types frequently mentioned as suitable include fresh marshes, bogs, prairies, grassy plains, old fields, river valleys, meadows, savanna, and open woodland.	Yes
Swainson's warbler	*Limnothlypis swainsonii*	Breeding	Rich, damp, deciduous floodplain and swamp forests; requires areas with deep shade from both canopy and understory cover.	No
Willow flycatcher	*Empidonax traillii*	Breeding	Strongly tied to brushy areas of willow and similar shrubs. Found in thickets, open second growth with brush, swamps, wetlands, streamsides, and open woodland.	Yes

Table 3.10-1. Migratory Birds Identified by the IPaC Trust Resources Report[1] as Birds of Conservation Concern for the SHF Area

Common Name	Scientific Name	Season of Occurrence	Habitat[1]	Potential Habitat in Project Area?
Wood thrush	*Hylocichla mustelina*	Breeding	Deciduous or mixed forests with a dense tree canopy and a fairly well-developed deciduous understory, especially where moist.	Yes
Worm-eating warbler	*Helmitheros vermivorum*	Breeding	Well-drained, upland, deciduous forests with understory patches of mountain laurel or other shrubs, drier portions of stream swamps with an understory of mountain laurel, deciduous woods near streams; almost always associated with hillsides.	No

[1] USFWS (2016)

[2] Source of habitat information: NatureServe (2017)

3.10.2 Environmental Consequences

3.10.2.1 Alternative A – No Action

Under Alternative A, TVA would not close the former SWL or Ash Impoundment 2, or construct the proposed CCR Landfill. No construction would occur; therefore, resident wildlife found in the project area would continue to opportunistically use available habitats within the project area. No tree clearing would occur and, therefore, no impacts would occur to migratory bird or mammal species. As conditions would be unchanged, no direct or indirect impacts to wildlife would occur under the No Action Alternative.

3.10.2.2 Alternative B – Construction of Onsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

Under Alternative B, no natural habitat would be affected in the 496-acre Ash Impoundment 2 and former SWL area on the SHF facility. The industrial pond would be closed, and the limited, low-quality habitat it provides for wading birds, shorebirds, and waterfowl would be eliminated. However, based on the abundance of natural habitats along the Ohio River and in sloughs, creeks, ponds, and lakes of the region, the impact to birds using these aquatic habitats would be minimal. Birds and mammals that currently utilize the former SWL for foraging would return after construction and the establishment of vegetation, which would result in a larger area of habitat consisting of mowed fields of grass and other herbaceous vegetation. The habitat would be of marginal quality, however, and is not anticipated to support large populations of these species. The project will eliminate some open water area in Ash Impoundment 2 currently utilized by waterfowl, shorebirds, and wading birds and will eliminate approximately 68 acres of woodland at the Shawnee East Site. These areas may be utilized by migratory birds as well as year-round residents. However, with the 6,425 acres of the WKWMA nearby and extensive open-water and shoreline habitats in the area, no noticeable impacts to populations of birds in the region are anticipated.

Impacts to wildlife would occur at the Shawnee East Site due to the clearing of approximately 205 acres. Hundreds of acres of woodlands, croplands, and old fields are present in the vicinity; therefore, wildlife that currently occupies habitats in the area to be cleared would be permanently displaced to similar habitats in the surrounding area. TVA has purchased additional land as a buffer to the proposed CCR Landfill to the south and east, and it owns undeveloped land to the west, which will also provide habitat for displaced wildlife. The nearby 6,425 acres of the adjacent WKWMA also provides all habitat types that would be affected by the construction of the proposed CCR Landfill and adequate wilderness for any wildlife displaced from the approximately 68 acres of woodland and approximately 135 acres of former cropland within the Shawnee East Site. Direct impacts to less-mobile species or life stages (e.g., eggs or juveniles in the nest) could occur during the clearing and grading process. The habitats present in areas that would be disturbed are not unusual, and the species affected are likely to occur throughout the project vicinity. The loss of some individuals would not impact overall wildlife populations near the Shawnee East Site.

Following the construction phase at the proposed CCR Landfill, wildlife use of the area would be limited due to ongoing landfill operations. However, the areas of herbaceous vegetative cover, once established, could be used by grassland-dependent species.

Proposed actions at the Shawnee East Site may result in direct impacts to individuals of some wildlife species, depending on the timing of vegetation removal and the mobility of the species. Mobile wildlife, including migratory birds, would be displaced to other habitats in the vicinity. However, wildlife populations would not be substantially reduced, the habitats that would be affected are not rare in the vicinity, and impacts to wildlife in the region would not be noticeable and would be considered minor. Therefore, direct and indirect impacts on wildlife from this alternative would not be significant.

3.10.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

The closure of the former SWL and Ash Impoundment 2 would be the same under Alternative C as described previously for Alternative B. The impacts associated with Alternative C would be the same as Alternative B in the area of existing onsite facilities (the 496 acres included in the former SWL and Ash Impoundment 2). However, the impacts would be less than Alternative B overall because the proposed CCR Landfill would not be constructed on the Shawnee East Site. As under Alternative B, soil from the Shawnee East Site would be removed under Alternative C and transported to the SHF facility for use as borrow material in the closure of Ash Impoundment 2 and the former SWL. The removal of this borrow material would result in the clearing of vegetation and removal of habitats from parts of the proposed area of disturbance within the Shawnee East Site. The effects on wildlife would be similar to those discussed for Alternative B, although the habitats potentially affected would be smaller. CCR produced at SHF would be hauled to an existing, permitted offsite landfill with sufficient capacity that expansion requiring the clearing of additional wildlife habitat at that site would be unlikely. Therefore, impacts to wildlife from Alternative C would be less than those from Alternative B, would not noticeably impact wildlife populations of the region, and would be considered minor. Direct and indirect impacts on wildlife from this alternative would not be significant.

3.11 Aquatic Ecology

3.11.1 Affected Environment

SHF and the Shawnee East Site are located approximately 10 miles west of Paducah, Kentucky along the Ohio River and within the Ohio River−Bayou Creek Hydrologic Unit (Code 051402060701). The Wabash−Ohio Bottomlands ecoregion is composed of nearly level, poorly-drained floodplains and undulating terraces (Woods et al 2002). Natural streams in this region generally are low-gradient, meandering channels with silt and sand bottoms, often filled with woody debris, and inhabited by fish fauna typical of the Ohio River basin. Much of the ecoregion is heavily forested with southern floodplain forest and bottomland mixed deciduous forests. The SHF facility and the Shawnee East Site are bordered by the Ohio River on the north, Little Bayou Creek on the west and south, and an unnamed tributary to the Ohio River on the east, which are all classified as warm-water aquatic habitat (see Figure 3.7-1) (TVA 2016d).

The Ohio River Valley Water Sanitation Commission operates programs to improve water quality in the Ohio River and its tributaries, including setting wastewater discharge standards, performing biological assessments, and monitoring the physical and chemical properties of the waterway. Fish population data were collected in 2009 at 17 randomly selected locations throughout the reach of the Ohio River near SHF. Forty-eight fish species and one hybrid taxon were collected, representing 13 families. Overall, the most abundant species collected was gizzard shad, with large numbers of freshwater drum, river carpsucker, channel catfish, sauger, longear sunfish, yellow bass, and bluegill also collected. Benthic substrate samples collected in the river revealed that it is dominated by sand, followed by fines, then gravel. Woody cover was present at all of the 17 sample sites, and riparian land cover was primarily natural forest with some agriculture and residential uses present (Ohio River Valley Water Sanitation Commission 2009). The section of the Ohio River adjacent to SHF is within the reach of the river that has been designated as critical habitat for the rabbitsfoot mussel (see Section 3.12, Threatened and Endangered Species).

The Ohio River Ecological Research Program conducts river monitoring studies in the Ohio River using juvenile and adult fish surveys, habitat evaluations, and water quality studies, and it has monitored the Ohio River fishery for 42 years. Through 2012, fish surveys have been conducted near SHF 12 times, beginning in 1987. The 2012 adult and juvenile fish surveys near SHF yielded 9,261 fish, representing 48 species and one hybrid striper. Numerically, the combined catch was dominated by threadfin shad, emerald shiner, gizzard shad, freshwater drum, and channel shiner. Other abundant species included the common carp, grass carp, river shiner, channel catfish, longear sunfish, bluegill, sauger, river carpsucker, shortnose gar, longnose gar, and yellow bass. Catch parameters (species richness and diversity, modified Ohio River Fish Index [mORFIn] and modified Index of Well-Being [IWBmod]) were calculated for electrofishing samples to characterize the fish community in the reach of the river at SHF and to quantify variability between sampling areas upstream and downstream of SHF (EPRI 2014). Species richness, diversity, mORFIn scores, and IWBmod scores were somewhat higher upstream of the plant (Table 3.11-1). The mORFIn condition ratings of good to very good, based on electrofishing data, indicate that the river study area adjacent to SHF supported its designated aquatic life use classification both upstream and downstream of the facility. In contrast to electrofishing, the net fishing data showed minimal spatial differences, and species richness was the same upstream and downstream. The lack of correlations of the community-level parameters with water temperature suggests that the higher upstream catches in 2012 were due to differences in habitat or other factors rather than a response to the SHF discharge. Analysis of historical trends in the scores and other measures indicate an improving fishery near SHF (EPRI 2014).

At the Shawnee East Site, aquatic resources are limited to small ponds, wetlands, and a small stream on a small tract of land purchased on the east side of Metropolis Lake Road. These ponds, wetlands, and stream were inspected during field surveys in October and November 2016. Most ponds appeared to be shallow with little or no aquatic life other than invertebrates. Some ponds provide habitat for amphibians, mostly frogs and salamanders. No sign of fish life was observed in any pond. In the approximately 205-acre Shawnee East Site, a total of three small ponds contained water. Water levels in each pond were estimated at no more than 1 foot deep, and it appeared that these ponds could easily go dry during periods of drought.The Federal Clean Water Act Section 303(d) requires that states develop a list of the streams and lakes that need additional pollution controls because they are water quality limited or are expected to exceed water quality standards in the next 2 years. Streams where water quality is limited are those that have one or more properties that violate water quality standards and are, therefore, considered to be degraded by pollution and not fully meeting designated uses. Statuses of the assessed uses on the Ohio River and Little Bayou Creek are identified in Section 3.7.1. As discussed in that section, a generally balanced, indigenous, aquatic community exists in the Ohio River adjacent to SHF (KDEP 2013b), though fish consumption advisories remain in effect for Little Bayou Creek due to pollutants that include metals and radiation (KDEP 2013b).

Table 3.11-1. Catch Parameters for Characterizing the Fish Community (Fish Collected by Electrofishing Upstream and Downstream of Shawnee Fossil Plant, 2012)

Parameter	Upstream	Downstream
Species Richness	21.9	17.9
Diversity	2.2	2.1
mORFIn	43.6 Very Good	33.2 Good
IWBmod	9.5	8.7

Source: EPRI (2014)

3.11.2 Environmental Consequences

3.11.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations at the former SWL and Ash Impoundment 2, and would not close either of those facilities. No closure activities would occur under the No Action Alternative. The impoundments would continue to receive the storm water and other process wastewaters that they currently receive. The KPDES-permitted discharges at SHF would remain operational, and the characteristics of the discharges would continue to meet required permit limits. The proposed CCR Landfill would not be constructed at the Shawnee East Site, and there would be no impact to the aquatic ecology of the small ponds and stream of this area. Fish populations in the Ohio River would be expected to remain the same.

Because there would be no operational changes from the current conditions, there would be no direct or indirect impacts affecting aquatic ecology as a result of this alternative.

3.11.2.2 Alternative B – Construction of Onsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

Under Alternative B, TVA would close Ash Impoundment 2 by closure-in-place through reduced footprint, close its former SWL in-place, and construct and operate the proposed CCR Landfill onsite at SHF. There are no floodplains present within the Shawnee East Site; however, the site does contain a stream, small ponds, and wetlands.

Numerous wetlands of varying sizes are scattered throughout the Shawnee East Site that could be affected by construction and operation activities. Potential indirect impacts resulting from surface water runoff during construction activities would be mitigated through the implementation of storm water erosion controls in accordance with an SWPPP that will be prepared for this project. Additionally, spatially situating the proposed CCR Landfill footprint to satisfy buffer area requirements would prevent permanent alterations to the aquatic ecology in ponds and wetland areas.

No direct impacts to aquatic ecosystems of the Ohio River or Little Bayou Creek would occur in conjunction with the construction of the proposed CCR Landfill, closure of Ash Impoundment 2, and closure of the former SWL at SHF. Fish, mussels, and other aquatic fauna of the Ohio River would not be affected by continued operation of the facility as the proposed project area is not in close proximity to the Ohio River or its shorelines. Three small, shallow ponds would be removed by the construction of the proposed CCR Landfill; however, each pond is an isolated, man-made structure with no sustained hydrology and minimal populations of aquatic life.

Primary construction activities associated with the closure of Ash Impoundment 2 and the former SWL would be located within the footprint of the existing features. Dewatering the ash impoundment prior to construction, followed by the installation of an approved cover system, would effectively reduce water inputs to the impoundment, thereby eliminating the KPDES permitted discharge associated with the Ash Impoundment 2. The wastewater discharges during dewatering would meet existing permit limits, and compliance sampling would continue to be performed at the approved outfall structure in accordance with the KPDES permit to demonstrate compliance. Additional monitoring would be undertaken as appropriate to better track discharge constituents (TVA 2016b).

Because ash impoundments are considered treatment systems and not aquatic habitat, and because laydown areas would avoid encroachment on or alteration of streams and waterbodies to the extent practicable, direct impacts to aquatic habitat would primarily be avoided with closure activities. Indirect impacts to adjacent streams and reservoirs may be associated with storm water runoff due to temporary construction activities associated with site preparation and capping. Any construction activities will adhere to permit limit requirements and would utilize BMPs to minimize direct and indirect effects on aquatic resources during the construction phase. Following the construction phase, care and maintenance of the approved closure system and site-wide management of storm water using appropriate BMPs would minimize indirect impacts to the aquatic community of receiving waters (TVA 2016b). Overall, the impacts to aquatic ecology associated with Alternative B would be minor, and direct and indirect impacts would not be significant.

3.11.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

The closure of the former SWL and Ash Impoundment 2 would be the same under Alternative C as described previously for Alternative B. Under Alternative C, TVA would transport and dispose of dry CCR in an existing, permitted, offsite landfill. The impacts associated with Alternative C would be similar to but less than those from Alternative B because a new landfill would not be constructed. Direct and indirect impacts on aquatic ecology from this alternative would not be significant.

3.12 Threatened and Endangered Species

3.12.1 Affected Environment

The Endangered Species Act provides broad protection for species of animals and plants that are listed by the federal government as threatened or endangered in the United States or elsewhere. The Endangered Species Act outlines procedures for federal agencies to follow when taking actions that may affect federally listed species or their designated critical habitat. In addition to species federally listed under the Endangered Species Act, the State of Kentucky also provides protection for species it considers threatened, endangered, or of special concern within the state (KDFWR 2013). The listing of species is managed by the KDFWR. Additionally, the Kentucky State Nature Preserves Commission (KNSPC) and TVA both maintain databases of terrestrial and aquatic species that are considered threatened, endangered, or of special concern in Kentucky.

Table 3.12-1 lists the species with federal or state status that have recorded occurrences in McCracken County.

Table 3.12-1. Species with Federal or State Status in McCracken County, Kentucky[1]

Common Name	Scientific Name	Status	
		Federal [2]	State [3]
Birds			
Sharp-shinned Hawk	*Accipiter striatus*	--	SPCO
Bachman's Sparrow	*Aimophila aestivalis*	--	END
Henslow's Sparrow	*Ammodramus henslowii*	--	SPCO
Fish Crow*	*Corvus ossifragus*	--	SPCO
Mississippi Kite	*Ictinia mississippiensis*	--	SPCO
Hooded Merganser*	*Lophodytes cucullatus*	--	THR
Osprey	*Pandion haliaetus*	--	SPCO
Bank Swallow	*Riparia riparia*	--	SPCO
Interior Least Tern	*Sterna antillarum athalassos*	LE	END
Barn Owl	*Tyto alba*	--	SPCO
Bell's Vireo*	*Vireo bellii*	--	SPCO
Mammals			
Gray Bat	*Myotis grisescens*	LE	END
Indiana Bat*	*Myotis sodalis*	LE	END
Northern Long-eared Bat*	*Myotis septentrionalis*	LT	END
Southeastern Myotis*	*Myotis austroriparius*	--	END
Evening Bat*	*Nycticeius humeralis*	--	SPCO
Cotton Mouse	*Peromyscus gossypinus*	--	THR
Reptiles			
Midland smooth softshell	*Apalone mutica mutica*	--	SPCO
Western mud snake	*Farancia abacura reinwardtii*	--	SPCO
Alligator snapping turtle	*Macrochelys temminckii*	--	THR
Eastern ribbon snake	*Thamnophis sauritus sauritus*	--	SPCO
Amphibians			
Green Treefrog*	*Hyla cinerea*	--	SPCO
Northern Crawfish Frog*	*Rana areolata circulosa*	--	SPCO
Fishes			
Alligator Gar**	*Atractosteus spatula*	--	END
Blacktail Shiner	*Cyprinella venusta*	--	SPCO
Lake Chubsucker**	*Erimyzon sucetta*	--	THR
Lake Sturgeon	*Acipenser fulvescens*	--	END
Chain Pickerel**	*Esox niger*	--	SPCO
Cypress Darter	*Etheostoma proeliare*	--	THR
Cypress Minnow**	*Hybognathus hayi*	--	END
Chestnut Lamprey	*Ichthyomyzon castaneus*	--	SPCO
Mountain Brook Lamprey**	*Ichthyomyzon greeleyi*	--	THR
Black Buffalo**	*Ictiobus niger*	--	SPCO
Dollar Sunfish	*Lepomis marginatus*	--	END
Redspotted Sunfish**	*Lepomis miniatus*	--	THR
Burbot	*Lota lota*	--	SPCO
Inland Silverside**	*Menidia beryllina*	--	THR
Tailight Shiner**	*Notropis maculatus*	--	THR
Northern Madtom**	*Noturus stigmosus*	--	SPCO
Central Mudminnow	*Umbra limi*	--	THR
Mussels			
Pink Mucket**	*Lampsilis abrupta*	LE	END
Spectaclecase	*Cumberlandia monodonta*	LE	END
Fanshell	*Cyprogenia stegaria*	LE	END

Table 3.12-1. Species with Federal or State Status in McCracken County, Kentucky[1]

Common Name	Scientific Name	Status	
		Federal [2]	State [3]
Longsolid	*Fusconaia subrotunda*	--	SPCO
Pocketbook	*Lampsilis ovata*	--	END
Ring Pink	*Obovaria retusa*	LE	END
Orangefoot Pimpleback**	*Plethobasus cooperianus*	LE	END)
Sheepnose**	*Plethobasus cyphyus*	LE	END
Clubshell	*Pleurobema clava*	LE	END
Pyramid Pigtoe	*Pleurobema rubrum*	--	END
Fat Pocketbook**	*Potamilus capax*	LE	END
Bleufer	*Potamilus purpuratus*	--	END
Rabbitsfoot**	*Quadrula cylindrica cylindrica*	LT	THR
Purple Lilliput	*Toxolasma lividus*	--	THR
Rough Pigtoe	*Pleurobema plenum*	LE	--
Aquatic Snails			
Onyx Rocksnail	*Leptoxis praerosa*	--	SPCO
Furrowed Lioplax	*Lioplax sulculosa*	--	SPCO
Ornate Rocksnail	*Lithasia geniculata*	--	SPCO
Varicose Rocksnail	*Lithasia verrucosa*	--	SPCO
Crustaceans			
Swamp dwarf crayfish	*Cambarellus puer*	--	END
Shrimp crayfish	*Orconectes lancifer*	--	END
Gray-speckled crayfish	*Oronectes palmeri palmeri*	--	END
Insects			
Dukes' skipper	*Euphemes dukesi*	--	THR
Rare cane borer moth	*Papipema sp. 5*	--	THR
Northern oak hairstreak	*Satyrium favonius ontario*	--	SPCO
Plants			
Red Buckeye	*Aesculus pavia*	--	THR
Lakecress	*Armoracia lacustris*	--	THR
Cream Wild Indigo	*Baptisia bracteata var. glabrescens*	--	SPCO
Broadwing Sedge	*Carex alata*	--	THR
Porcupine Sedge	*Carex hystericina*	--	HIST
Water Hickory*	*Carya aquatica*	`--	THR
Five-lobe Cucumber	*Cayaponia quinqueloba*	--	END
Rose Turtlehead	*Chelone obliqua* var. *speciosa*	--	SPCO
Star Tickseed*	*Coreopsis pubescens*	--	SPCO
Water Locust	*Gleditsia aquatica*	--	SPCO
Common Silverbell	*Halesia carolina*	--	END
Broadleaf Golden-aster	*Heterotheca subaxillaris* var. *latifolia*	--	THR
Ovate Fiddleleaf	*Hydrolea ovata*	--	END
One-flower Fiddleleaf	*Hydrolea uniflora*	--	END
Creeping St. John's-wort	*Hypericum adpressum*	--	HIST
Zigzag Iris	*Iris brevicaulis*	--	THR
Tall Bush-clover	*Lespedeza stuevei*	--	THR
Snow Squarestem	*Melanthera nivea*	--	SPCO
Spotted Bee-balm	*Monarda punctata*	--	EXT
Hair Grass	*Muhlenbergia glabrifloris*	--	SPCO
Broadleaf Water-milfoil	*Myriophyllum heterophyllum*	--	SPCO
Spotted Pondweed	*Potamogeton pulcher*	--	THR

Table 3.12-1. Species with Federal or State Status in McCracken County, Kentucky[1]

Common Name	Scientific Name	Status	
		Federal [2]	State [3]
Rough Rattlesnake-root	*Prenanthes aspera*	--	END
Sweet Coneflower	*Rudbeckia subtomentosa*	--	END
Buckley's Goldenrod	*Solidago buckleyi*	--	SPCO
Pale Manna Grass	*Torreyochloa pallida*	--	HIST
Trepocarpus	*Trepocarpus aethusae*	--	SPCO

* Terrestrial species documented within 5 miles of SHF.
** Aquatic species documented within 10 miles of SHF.
[1] Sources: KSNPC (2015), KSNPC (2016a), TVA RNHD (TVA 2016), and USFWS IPaC (USFWS 2016a).
[2] Federal Status Codes: LT = Listed Threatened; LE = Listed Endangered
[3] Kentucky State Status Codes: END = listed endangered; EXT = extirpated; HIST = state historic; SPCO = species of special concern; THR = listed threatened.

3.12.1.1 Plants

There are 27 plant species with state status that have recorded occurrences in McCracken County (Table 3.12-1). No federally listed plant species have recorded occurrences in this county. Six of the state-status species are state-listed as endangered, eight are state-listed as threatened, nine have a state status of special concern, three are known only from historical records, and one is considered to have been extirpated from the county. Habitat requirements for each of these state-status species are presented in Table 3.12-2. A review of the TVA Regional National Heritage Database indicated that only two of these plant species are known to occur within 5 miles of the proposed project site: water hickory and star tickseed. The KSNPC database identified water hickory, as well as four additional species, as occurring within 1 mile of the proposed landfill site: common silverbell, snow squarestem, hair grass, and trepocarpus. Descriptions of these species are provided below.

Water hickory is state-listed as threatened. It is a large tree species associated with bottomland forests and floodplain swamps that have standing water for a portion of the year (NatureServe 2016). Wet woodland areas in the Shawnee East Site could provide low-quality habitat for the water hickory, but due to the land's repeated disturbance it is unlikely that the species would become established in such fragmented patches of wet, woodland areas. No individuals of this species were observed by AECOM during the vegetation survey of the Shawnee East Site in November 2016 (see Vegetation Field Survey Report, Appendix B).

Star tickseed has a state status of special concern. It is a perennial herb associated with open woodlands, dry slopes and cliffs, and back edges of boulder-cobble bars near riverbanks (NatureServe 2016). The star tickseed has also been recorded to become established along the edges of forested wetlands. There is a potential that star tickseed could survive in dry, upland, woodland areas of the Shawnee East Site, but no individuals of this species were observed by AECOM during the vegetation survey of the Shawnee East Site.

Common silverbell is state-listed as endangered. Its range includes mostly the Piedmont and mountains of the southeast United States, with small populations scattered over a wider area, including western Kentucky and the southern tip of Illinois. It is a small tree that prefers moist soils along streams in the understory of hardwood forests (Burns and Honkala 1990). Its habitat also includes rich woods and the edges of sloughs and oxbow lakes, and it has been recorded within 1 mile of the Shawnee East Site (KSNPC 2016a). Given the absence of streams, sloughs, and oxbow lakes in the proposed area of disturbance and the fact that common silverbell was not observed during the vegetation survey of the property, its occurrence in this area is unlikely. However, there is a possibility that this tree could occur within the understory of hardwood forest areas on the property.

Snow squarestem has a state status of special concern. Its range includes mostly the southeast United States, extending to western Kentucky and the southern tip of Illinois (NatureServe 2017). It is a perennial herb associated with floodplains and wet/moist sandy woods, including disturbed openings, and it has been recorded within 1 mile of the Shawnee East Site (KSNPC 2016a). Snow squarestem was not observed during the vegetation survey of the proposed landfill property, and the survey did not find its preferred habitat to be present.

Hair grass has a state status of special concern. Its range includes mostly the southeast United States, extending to western Kentucky and the southern tip of Illinois (NatureServe 2017). It is a perennial grass with erect stems approximately 3 feet tall. It tends to occur in areas where there has been repeated disturbance, and it can occur in two very different types of habitats: dry soils of prairies, gravels, and rocky slopes, generally at the edges of forests; and wet soils of bottomland woods and at the edges of marshes (KSNPC 2016a). Hair grass has been recorded within 1 mile of the Shawnee East Site, although that observation is historical from 1977 (KSNPC 2016a). This species was not observed during the vegetation survey of the proposed landfill property, and the survey did not find its preferred habitat to be present.

Trepocarpus has a state status of special concern. Its range includes mostly the southeast United States, extending north to western Kentucky and southern Missouri and west to Texas (NatureServe 2017). Trepocarpus is an annual herb and a wetland species that is associated with the margins of swamp forests, sandy river bottoms, and exposed shorelines. It has been recorded within 1 mile of the Shawnee East Site (KSNPC 2016a). Trepocarpus was not observed during the vegetation survey of the proposed landfill property, and the survey did not find its preferred habitat to be present.

Based on their preferred habitats, a number of these state-status plants potentially could utilize habitats that exist on the Shawnee East Site at SHF. However, no threatened or endangered plant species were observed during the field survey of the Shawnee East Site in November 2016 (see Vegetation Field Survey Report, Appendix B).

Table 3.12-2. Habitat Requirements for Plant Species with State Status in McCracken County, Kentucky

Common Name	Habitat Requirements	Habitat within Project Area
Red Buckeye	Swamp forests and rich damp woods[1]	Yes
Lakecress	Sloughs, cypress swamps, slow water[1]	No
Cream Wild Indigo	Prairies and open dry woods[1]	Yes
Broadwing Sedge	Peaty shores, marshes, wet thickets, woods[2]	No
Porcupine Sedge	Open swamps, sedge meadows, ponds, in calcareous substrates[2]	No
Water Hickory*	Bottomland and floodplain swamps[1]	No
Five-lobe Cucumber	Bottomlands along bayous, swamp forests, riverbanks[1]	No
Rose Turtlehead	Floodplain and alluvial forests, swamps and sloughs[1]	No
Star Tickseed*	Open woods, dry slopes and cobble bars near riverbanks[1]	No
Water Locust	Rivers, swamps and slough margins[1]	No
Common Silverbell	Rich woods and edges of sloughs and oxbow lakes[1]	Yes
Broadleaf Golden-aster	Dry, sandy places and disturbed sites[1]	Yes
Ovate Fiddleleaf	Swamps and wet woods[1]	Yes
One-flower Fiddleleaf	Swampy woodlands, pond margins and wet ditches[1]	Yes
Creeping St. John's-wort	Acidic soils of fresh water open wetland areas[4]	No
Zigzag Iris	Forested and open wetlands, shorelines[1]	Yes
Tall Bush-clover	Dry woodlands[1]	Yes
Snow Squarestem	Floodplains and wet sandy woods[1]	No
Spotted Bee-balm	Sandy prairies and other sandy habitats[3]	No
Hair Grass	Dry/baked soils in prairies, rocky slopes, marsh edges of bottomland woods[1]	No
Broadleaf Water-milfoil	Ponds, ditches, slow streams[1]	No
Spotted Pondweed	Ponds, slow streams, swamps[1]	No
Rough Rattlesnake-root	Dry prairies, limestone glades, open rocky woods in acidic soils[1]	Yes
Sweet Coneflower	Prairies and open low areas[1]	Yes
Buckley's Goldenrod	Dry mesic woods[1]	Yes
Pale Manna Grass	Bogs, fens, wetland habitats[4]	Yes
Trepocarpus	Margins of swamp forests and sandy river bottoms[1]	No

*Species documented within 5 miles of SHF.
1 KSNPC (2015)
2 Flora of North America Committee (2010)
3 Illinois DNR (2016)
4 NatureServe (2016)

3.12.1.2 Terrestrial Wildlife

The wildlife included in this section are terrestrial animals (although some occupy aquatic habitats, they breathe air). According to the Kentucky State Nature Preserves Commission, 26 terrestrial animal species with federal or state status have recorded or expected occurrences in McCracken County (Table 3.12-1). The Resources Report for McCracken County from the USFWS IPaC website identified four federally listed animal species (one bird and three bats) that have the potential to occur in the project area. A review of the TVA Regional Natural Heritage Database in November 2016 indicated that of those species listed by USFWS and the KSNPC, nine species are currently known or have been known to occur within a 5-mile radius of the project area (Table 3.12-1). These terrestrial wildlife species with recorded occurrences within 5 miles of SHF are discussed below.

3.12.1.1.1 Birds

Of the bird species with recorded occurrences in McCracken County, one is federally listed as endangered, one is state-listed as endangered, one is state-listed as threatened, and eight have a state status of special concern. Five of these bird species have been reported within 5 miles of the project site by the TVA Regional National Heritage Database (TVA 2016e) and data obtained from the KSNPC (2016a): Bell's vireo, fish crow, hooded merganser, interior least tern, and osprey.

The interior least tern is federally listed as endangered. It is a small, gull-like bird with a light gray body and a black cap. The interior least tern nests on open shorelines, riverine sandbars, and mudflats throughout the Mississippi, Missouri, Arkansas, and Red River drainages. Small numbers of this species have been sporadically reported from the lower Ohio River, but the majority of records of this species in Kentucky are from along the Mississippi River (Palmer-Ball 1996). Least terns also have been documented using inland sites created by humans, such as dredge spoil and stilling ponds associated with coal plants, where site characteristics mimic to some degree their natural habitat (Spear et al. 2007; Jenniges and Plettner 2008). The least tern utilizes shoreline habitat of the Ohio River in summer, and it potentially could nest on areas of exposed gravel in Ash Impoundment 2. The two small ponds in the area of disturbance for the proposed CCR Landfill are unlikely to provide suitable foraging habitat. No use of these habitats at SHF by this species has been reported, and no terns were observed during site surveys. No critical habitat has been designated for the interior least tern in the vicinity of SHF.

The hooded merganser is a small duck that is state-listed as threatened. It is known to occur in a large wetland immediately adjacent to the ash settling pond. Hooded mergansers are usually found in shallow waters of wetlands, sloughs, and ponds in the floodplains of major rivers (Palmer-Ball 1996). Like many bird species in the region, hooded mergansers may infrequently and opportunistically use the bottom ash impoundment and trench that would be impacted by the proposed impoundment closure actions. However, there is abundant, higher-quality habitat nearby in riparian areas of the Ohio River, in Metropolis Lake immediately east of SHF, in ponds and wetlands immediately west of Ash Impoundment 2, and elsewhere in the floodplain.

The fish crow is a small crow that has a state status of special concern. It has been recorded approximately 1.4 miles west of SHF in forested habitat along the Ohio River. The fish crow forages along the shores of waterbodies and is found primarily in floodplains, on exposed sand bars, and in agricultural fields along major waterways in the interior portion of its range (Palmer-Ball 1996, NatureServe 2016). Due to the proximity of SHF to the Ohio River and Metropolis Lake, transient fish crows may be observed flying over the project area or using the adjacent forested areas for perching, but this species is unlikely to be dependent on the habitat available within the SHF facility project area due to the proximity of higher-quality habitat near the Ohio River. The fish crow potentially could forage in the former agricultural fields or nest in larger trees within the Shawnee East Site.

Bell's vireo is a small songbird that has a state status of special concern. It nests and forages in dense shrub vegetation (NatureServe 2016). Two pairs of Bell's vireos were observed on SHF property approximately 0.3 mile from the proposed project area in 1980. One of the pairs was building a nest. The birds were observed among shrubs and saplings along a level area adjacent to Little Bayou Creek. Suitable habitat for this species may exist immediately adjacent to the project area in the same location as the 1980 sightings as well as in the early successional areas of the woodlands in the Shawnee East Site. No suitable habitat for this species occurs within the Ash Impoundment 2 and former SWL area. An abundance of high quality habitat is located adjacent to the Shawnee East Site in the buffer area of the property purchased by TVA and in the nearby WKWMA.

The osprey is a large raptor with dark brown wings and a white underside. It is state-listed as a species of concern and is not known to occur within 5 miles of SHF. The osprey forages and nests along waterways (NatureServe 2016). Nests are constructed on natural and man-made structures in and around larger bodies of water where fish are abundant (Palmer-Ball 1996). Due to the proximity of SHF to the Ohio River, ospreys may be observed flying over and/or nesting near the project area, but ospreys are unlikely to be found within the project area due to the lack of suitable nesting and foraging habitat.

3.12.1.1.2 Mammals

Five mammal species that are federally or state-listed as endangered or threatened and one species that has a state status of special concern are known to occur in McCracken County (Table 3.12-1). These species include the cotton mouse and four bats: the southeastern myotis, northern long-eared bat, Indiana bat, and evening bat. Although no records of the gray bat are known from McCracken County, the USFWS has determined that this species also has the potential to occur in this county. The Indiana bat, northern long-eared bat, southeastern myotis, and evening bat have been documented within 5 miles of the SHF by the TVA Regional National Heritage Database (TVA 2016e) and data from the KNSPC (2016).

The Indiana bat is federally listed as endangered. It is known to occur immediately west of the project area in the mature, forested lowlands near Bayou Creek, approximately 1.2 miles from Ash Impoundment 2 and the former SWL. Indiana bats hibernate in caves in winter and use nearby areas in fall and spring for swarming and staging prior to migration back to summer habitat. There are no records of caves within 5 miles of SHF. During the summer, Indiana bats roost under the exfoliating bark of dead and living trees in mature forests with an open understory, often near sources of water. Indiana bats are known to change roost trees frequently throughout the season yet still maintain site fidelity, returning to the same summer roosting areas in subsequent years. This species forages over forest canopies, along forest edges and tree lines, and occasionally over bodies of water (Pruitt and TeWinkel 2007, Kurta et al. 2002, USFWS 2015a). The project area is within known “Summer 1” maternity and roosting habitat for Indiana bats (USFWS 2016b). The project site on the SHF facility may be used by the Indiana bat for foraging over the ash impoundment and trench. Indiana bats may also forage and roost in the Shawnee East Site. A survey of the Shawnee East Site conducted in November 2016 confirmed a number of trees with exfoliating bark and snags (standing dead trees) in the woodland areas (Appendix C).

The northern long-eared bat is federally listed as threatened. Northern long-eared bats have also been captured during mist-net surveys in the area surrounding SHF on the WKWMA (DOE 2015 and KNSPC data exchange). This bat's range extends in the United States from Maine to North Carolina on the Atlantic Coast, westward to eastern Oklahoma, north through the Dakotas into eastern Montana and Wyoming, and southward to parts of southern states from Georgia to Louisiana. Suitable winter habitats (hibernacula) include underground caves and cave-like structures (e.g., abandoned or active mines, railroad tunnels). These hibernacula typically have large passages with significant cracks and crevices for roosting, relatively constant, cool temperatures (32 to 48°F), high humidity, and minimal air currents. During summer, this species roosts singly or in colonies underneath bark and in cavities, crevices, or hollows of both live and dead trees (typical diameter is greater than or equal to 3 inches). Males and non-reproductive females may also roost in cooler places, such as caves and mines. Northern long-eared bats forage for insects in upland and lowland woodlots, tree-lined corridors, and over water surfaces. In general, habitat use by northern long-eared bats is thought to be similar to that of Indiana bats, although northern long-eared bats appear to be more opportunistic in selection of summer habitat (USFWS 2015b). The project area is within known "Summer 1" roosting habitat for northern long-eared bats (USFWS 2016b). Similar to the Indiana bat, the Shawnee East Site may be used by the northern long-eared bat for foraging and summer roosting habitat. A survey of the Shawnee East Site conducted in November 2016 confirmed a number of trees with exfoliating bark and snags in the woodland areas (Appendix C).

The gray bat is federally listed as endangered. No records of this species exist from McCracken County, but the USFWS has determined that this area falls within the range of this species; thus, its presence in the project area is possible. The gray bat is associated year-round with caves, roosting in different caves throughout the year. Bats disperse from colonies at night to forage along waterways (Tuttle 1976). The Ohio River adjacent to SHF, wetlands adjacent to the project area, and the bottom ash impoundment and trench provide potential foraging habitat for gray bats that ranges from high to low in quality. Habitat in the Shawnee East Site is of low quality for gray bats as the few small ponds provide little open water. In addition, no caves are known within 5 miles of the project area, and none were observed during field surveys on the project site in November 2016.

The southeastern myotis is state-listed as endangered but is not federally listed. The range for this bat species extends throughout the southeastern United States, as far west as Texas and as far north as southern Illinois (NatureServe 2016). It is known to occur within 5 miles of SHF (KNSPC 2016a). This species overwinters in caves, often in association with the Indiana bat. In the summer months, some bats will remain in caves, but the majority move to cavities in snags, usually near a water source (Kentucky Department of Fish and Wildlife Resources 2016b). Similar to the Indiana bat, the Shawnee East Site may be used by the southeastern myotis for foraging and summer roosting habitat.

The evening bat has a state status of special concern. It is known to occur west of the project area in the mature, forested lowlands near Bayou Creek, approximately 1.2 miles from the bottom ash impoundment. This species is found in much of the eastern United States, ranging from Nebraska to New Jersey and south into Mexico. This bat is rarely found in caves and is primarily found in cavities in trees much like those used by the Indiana bat, southeastern myotis, and northern long-eared bat. Its winter roosting habitat is poorly known. Foraging occurs in open areas and around tree canopies (Harvey et al. 2011, NatureServe 2016). Similar to the Indiana bat and northern long-eared bat, the Shawnee East Site may be used by the evening bat for foraging and summer roost habitat, and the ash impoundment and trench also may be used by the evening bat for foraging.

Surveys were conducted in October and November 2016 to evaluate the suitability of habitats within the project area in the industrial area of the SHF facility and the bordering forested areas for federally listed bats and other threatened and endangered species (Appendix C). No caves or culverts of suitable size for roosting bats were observed within the project area on the SHF facility. Additionally, no suitable snags or living trees with loose bark were observed in the forested areas on or adjacent to Ash Impoundment 2 and the former SWL area. This section of the project area consists of developed land with a small mowed lawn. The grassy, open area within the facility may provide limited bat foraging habitat, but much higher quality habitat for these species exists within surrounding areas over forests and higher quality bodies of water.

On the Shawnee East Site, there are a number of live trees and snags, as well as two old barns, which could provide habitat for bats (Appendix C). The Shawnee East Site includes forested habitat that potentially could be used by the northern long-eared bat and Indiana bat for foraging and summer roosting (including maternity sites), and open fields and edges that could also be used for foraging. Therefore, a habitat assessment was conducted, focusing on potential habitats for these two federally listed bat species on the Shawnee East Site.

Specifically, a Phase 1 Summer Habitat Assessment for the Shawnee East Site at SHF was conducted on November 1 – 2, 2016. The assessment did not include an evaluation of aquatic environments, as they will not be impacted by the project. The purpose was to determine whether potential summer roost trees for the federally listed Indiana and northern long-eared bats are present on the Shawnee East Site and within the proposed landfill area of disturbance, where tree removal is likely. As a result of the habitat assessment, roost trees and roost tree areas were identified (Figure 3.12-1). Within the approximately 205-acre Shawnee East Site, approximately 68.4 acres of forest were identified as potential summer roosting habitat for Indiana and northern long-eared bats. The quality of these habitats ranged from suitable to marginally suitable.

3.12.1.1.3 Reptiles

One reptile species with a state status of threatened and three with a state status of special concern are known to occur in McCracken County (Table 3.12-1). According to data from the KNSPC (2016), only the midland smooth softshell turtle has been recorded within 5 miles of SHF. The range of the midland subspecies of the smooth softshell turtle includes the central United States, mainly the Mississippi River drainage, including the Ohio River and lower Allegheny River, as well as western rivers from the Dakotas to Texas. It inhabits rivers and streams as well as lakes, ponds, and ditches (Encyclopedia of Life 2017). Suitable habitats for the midland softshell turtle in the vicinity of the SHF project area include the Ohio River, Little

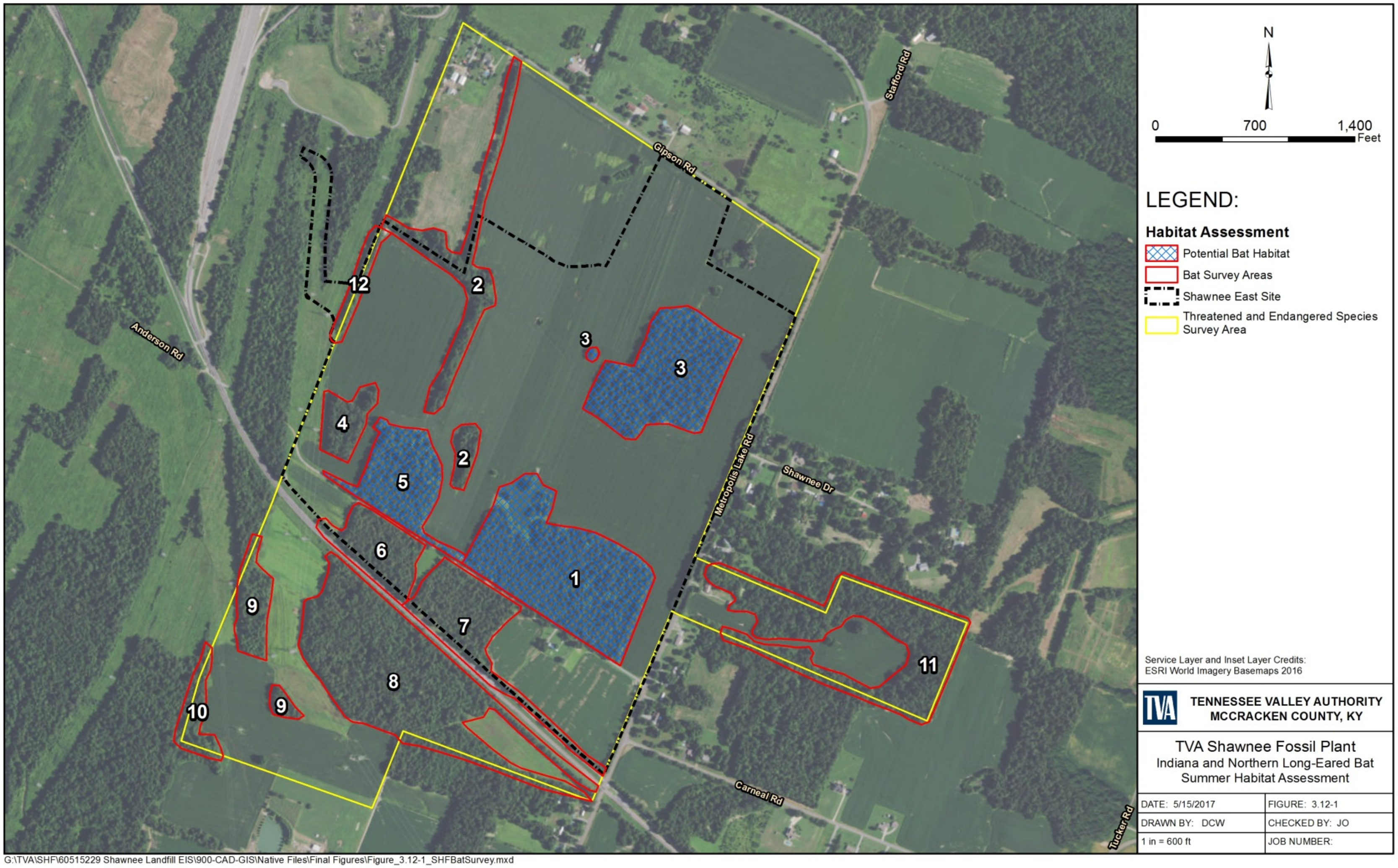


Figure 3.12-1. Bat Habitat on the Shawnee East Site

Bayou Creek, and Metropolis Lake. Suitable habitat does not occur within Ash Impoundment 2, which does not provide suitable cover and food sources, and the few ponds on the Shawnee East Site are too small and isolated from larger water bodies to provide habitat requirements. Accordingly, the midland smooth softshell turtle is not expected to occur on the SHF facility in Ash Impoundment 2 and former SWL project area or on the Shawnee East Site.

3.12.1.1.4 Amphibians

Two amphibians with a state status of special concern are known to occur in McCracken County within 5 miles of SHF. According to the TVA Regional National Heritage Database, there are 15 records of the northern crawfish frog within 5 miles of SHF, and the closest recorded occurrences of the northern crawfish frog are from the WKWMA, approximately 2.1 miles from the SHF project area. The preferred habitat of the northern crawfish frog is native prairie or former prairie low meadows and pasture areas. Breeding occurs in waterholes and ditches (Illinois Natural History Survey 2016). This habitat does not occur within Ash Impoundment 2 or the former SWL area on the SHF facility, but it does occur in the Shawnee East Site. Accordingly, the northern crayfish frog is not expected to occur on the SHF facility in the Ash Impoundment 2 and former SWL project area, but it may occur on the Shawnee East Site.

The green treefrog is known to exist in the riparian area associated with Bayou Creek, approximately 0.3 mile from SHF. Its preferred habitats are swamps, marshes, and areas adjacent to waterbodies with slow-moving water (NatureServe 2016). Based on the presence of multiple wetlands and small ponds within the Shawnee East Site, the green treefrog may occur within the project area.

3.12.1.1.5 Aquatic Ecology

The wildlife included in this section are aquatic animals that breathe water as adults. According to the KNSPC, 39 aquatic animal species with federal or state status have recorded or expected occurrences in McCracken County (Table 3.12-1). The Resources Report for McCracken County from the USFWS IPaC website identified ten federally listed animal species (mussels) that have the potential to occur in the project area. A review of the TVA Regional Natural Heritage Database in November 2016 indicated that of those aquatic species listed by USFWS and the KSNPC, 14 species are currently known or have been known to occur within a 10-mile radius of the project area (Table 3.12-1). Thirteen of these species occur in McCracken County and one in Massac County, Illinois (across the Ohio River). These aquatic wildlife species with recorded occurrences within 10 miles of SHF are discussed below

3.12.1.1.6 Fish

Ten fish species that are state-listed as endangered or threatened and three species that have a state status of special concern are known to occur within McCracken County. These fish species also have been recorded within a 10-mile radius of SHF based on the TVA Regional National Heritage Database (see Table 3.12-1). The proposed project area does not include any water bodies that would provide suitable aquatic habitats for these fish; therefore, these species are not expected to occur on the SHF facility or the Shawnee East Site.

3.12.1.1.7 Mussels

Fourteen freshwater mussel species federally or state-listed as endangered or threatened are known to occur in McCracken County, based on the USFWS and KNSPC (Table 3.12-1). Five of these mussel species, the pink mucket, sheepnose, orangefoot pimpleback, fat pocketbook, and rabbitsfoot, have been recorded within a 10-mile radius of SHF according to the TVA Regional Natural Heritage Database. All of these aquatic species require freshwater systems with flowing water (NatureServe 2016). No suitable stream habitat exists within the proposed project area, therefore, these mussel species are not expected to occur in the project area.

The reach of the Ohio River between Olmstead, Illinois and Paducah, Kentucky, which includes the portion of the river adjacent to SHF, is designated as critical habitat for the rabbitsfoot mussel (USFWS 2015c). Critical habitat includes specific areas (occupied or unoccupied by the species) in which are found physical or biological features essential to the conservation of the species (constituent elements) and which may require special management. The constituent elements for the rabbitsfoot critical habitat include: geomorphically stable river channels and banks; a hydrologic flow regime necessary to maintain benthic habitats where the species is found; water and sediment quality necessary to sustain natural physiological processes; the presence and abundance of fish hosts; and either little or no competitive or predaceous invasive species. The project area within the industrialized portion of the SHF facility is located adjacent to this critical aquatic habitat within the river, while the Shawnee East Site is approximately 1 mile south of the river. There is no critical habitat for the rabbitsfoot within the project area.

3.12.2 Environmental Consequences

3.12.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current facility operations and would not close its former SWL and Ash Impoundment 2. Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF or haul CCR to an existing permitted landfill. The impoundments would continue to receive the storm water and other process wastewaters that they currently receive. A number of species, including birds and bats, could continue to utilize Ash Impoundment 2 for foraging habitat. TVA would eventually cease using Ash Impoundment 2 once the dewatering facility is completed. Impacts associated with the completion of the dewatering facility have been previously considered. Overall, because there would be no changes from current or previously analyzed conditions, there would continue to be no direct or indirect effects on threatened or endangered species as a result of this alternative.

3.12.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Under Alternative B, TVA would close Ash Impoundment 2 through closure-in-place by reduced footprint, close its former SWL in-place, and construct and operate the proposed CCR Landfill on the Shawnee East Site at SHF. The area of the SHF facility that would be affected by project activities involving Ash Impoundment 2 and the former SWL under this alternative primarily consists of developed or disturbed land that is generally unsuitable for the listed species in Table 3.12-1. The closure of Ash Impoundment 2 and the trenches would result in the loss of a limited amount of open water that may currently be used as foraging habitat by federally and state-listed species such as bats, the interior least tern, and the hooded merganser. However, because there are thousands of acres of high quality, open-water habitat in the immediate area, those species that might utilize Ash Impoundment 2 on an infrequent basis would have ample areas of higher quality habitat in which to forage in and along the Ohio River, Metropolis Lake, Little Bayou Creek, and other water bodies in the vicinity.

Alternative B would also result in the clearing of vegetation from approximately 205 acres of land within the Shawnee East Site. This land consists of approximately 135 acres of old field, 68 acres of upland woods, and 5.5 acres of forested wetland. All of these vegetation communities are common in the adjacent 6,425-acre WKWMA and in the region. Much of the terrestrial habitat on the SHF facility has been severely degraded and is currently maintained as developed land or mowed lawn, which is generally unsuitable habitat for listed plant species with state status that have been recorded in the vicinity of SHF. The areas to be directly impacted by clearing for the proposed CCR Landfill are predominantly former agricultural fields that have been intensively altered and would not have provided suitable habitat for these plant species while used for agriculture. However, one state-endangered species and four state species of special concern potentially could occur in habitats that currently exist within the areas to be directly impacted by clearing for the proposed CCR Landfill.

Habitats on the Shawnee East Site may provide habitat conditions that could be suitable for common silverbell (state-listed as endangered) and star tickseed (state-listed species of concern). Survival of remnant populations of these species in this historically impacted area is unlikely, and these species were not observed in surveys. However, both of these state-status plants have been recorded within 5 miles of the landfill property (star tickseed within 1 mile), so their potential for occurrence is not discountable. No occurrences of federally listed plants have been recorded in McCracken County. Therefore, no direct or indirect effects on federally listed threatened or endangered plants are anticipated under Alternative B.

As indicated in the TVA Regional National Heritage Database, most sightings of state-listed terrestrial animal species in the area (i.e., northern crawfish frog, green tree frog, Bell’s vireo, and evening bat) have been documented in or near the WKWMA. Aquatic species have been documented either in the Ohio River or Metropolis Lake, neither of which would be impacted by Alternative B. The wooded areas on the Shawnee East Site have the potential to provide roosting habitat for federally and state-listed bat species, as well as foraging and nesting habitat for bird species with state status, particularly the fish crow and Bell’s vireo, which are species of special concern that have been recorded within 5 miles. Individuals of these two bird species are highly mobile and could avoid direct effects from clearing of habitat unless the disturbance affects eggs or nestlings. Adult birds would be displaced to similar habitats in the surrounding area, including the property purchased by TVA as buffer land to the south and east of the Shawnee East Site. Hundreds of acres of woodlands, croplands, and old fields are available in the area, including in the nearby WKWMA.

The two frogs that are state species of special concern and may occur on the Shawnee East Site could be directly affected, if present. Individuals of these species could be affected by injury or loss of habitat in the area of disturbance due to the removal of wetlands and ponds during the breeding season (either species) or the clearing of forests (green treefrog) and fields (northern crawfish frog) in any season. However, abundant woodlands, old fields, and wetlands are available nearby, including in the nearby WKWMA, and overall effects on local populations of these frogs are likely to be negligible.

Suitable habitat for federally and state-listed aquatic species does not occur within the project area; therefore, direct and indirect impacts are not anticipated to result from the implementation of Alternative B. Additionally, the proposed project would not adversely modify the critical habitat for the rabbitsfoot mussel within the Ohio River.

The habitat assessment for federally listed bats conducted in November 2016 (Appendix C) identified potential habitat for listed bat species within the Shawnee East Site. Based on review of the proposed approximately 205 acres of clearing for the CCR Landfill and the woodlands within that footprint, a total of approximately 68.4 acres of potential bat habitat was recorded during the bat habitat assessment. The quality of these habitats ranged from suitable to marginally suitable for use by summer-roosting Indiana and northern long-eared bats.

The only federally listed species that may be adversely affected under Alternative B are the Indiana bat and northern long-eared bat. These bats could be affected by the clearing of wooded areas for the proposed CCR Landfill. TVA consulted with USFWS under Section 7 of the ESA regarding the potential for impacts to these species. Potential direct and indirect impacts on these species would be avoided by scheduling the clearing of trees so that all potentially suitable roosting trees would be selectively removed between October 15 and March 31, the period when these bats would not be roosting in trees. The remaining trees would be cleared prior to June and July, the period when young are born and reared. Additionally, TVA would contribute to the Kentucky Bat Fund to mitigate the removal of this potential habitat.On May 30, 2017, the USFWS found that TVA’s requirements under Section 7 of the Endangered Species Act have been fulfilled.

The species with state status that potentially could be affected in the area of disturbance for the proposed CCR Landfill include one plant that is state-listed as endangered (common silverbell) and five species of special concern: one plant (star tickseed), two birds (fish crow and Bell’s vireo), and two frogs (green tree frog and northern crawfish frog). Based on the analysis provided above, the potential direct and indirect effects on the populations of these state-status species in the vicinity of SHF would be minor.

3.12.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

The closure of the former SWL and Ash Impoundment 2 on the SHF facility would be the same under Alternative C as described previously for Alternative B. Under Alternative C, however, TVA would utilize an offsite landfill where dry CCR would be transported and disposed of instead of constructing a new landfill on SHF property. As under Alternative B, soil from the Shawnee East Site would be removed under Alternative C and transported to the SHF facility for use as borrow material in the closure of Ash Impoundment 2 and the former SWL. The removal of this borrow material would result in the clearing of vegetation, possibly including forest, from parts of the proposed area of disturbance within the landfill property. The effects on federally listed species and state status species would be similar to those discussed for Alternative B, although the habitat areas potentially affected would be smaller.

As discussed in Subsection 2.2.3.1, the offsite landfill is currently permitted and operating in Kentucky. Its size is over 350 acres with over 30 years of permitted space. Given the capacity of the offsite landfill and the permitting requirements that would ensure the assessment of potential impacts on federally listed species, the potential direct and indirect impacts on threatened and endangered species associated with Alternative C would be less than under Alternative B and would be minor.

3.13 Wetlands

3.13.1 Affected Environment

Wetlands are protected under Sections 404 and 401 of the Clean Water Act and by EO 11990 (EPA 1972). In order to conduct specific activities in wetlands, authorization under a Section 404 permit from the USACE may be required, depending on the wetland’s size and hydrologic connectivity to a navigable waterway. Section 401 gives to states the authority to certify whether activities permitted under Section 404 are in accordance with state water quality standards. In Kentucky, the Department of Environmental Protection, Division of Water is responsible for issuing Section 401 water quality certifications. EO 11990 (Protection of Wetlands) requires federal agencies to avoid, to the extent possible, adverse impacts to wetlands and to preserve and enhance their natural and beneficial values. The USACE regulates the discharge of fill material into waters of the United States (WOTUS), including wetlands, pursuant to Section 404. Under the CCR Rule, EPA recognized the sensitivity of wetland environments and adopted a prohibition on locating CCR surface impoundments and new CCR landfills in wetlands, as well as lateral expansions of existing CCR units, in wetlands (EPA 2015). An exception to the wetlands location requirement applies where the owner-operator can make a multi-factored demonstration under the CCR Rule.

As defined in Section 404 of the Clean Water Act, wetlands are those areas inundated by surface or groundwater such that vegetation adapted to saturated soil conditions is prevalent. Examples include swamps, marshes, bogs, and wet meadows. Wetland fringe areas also are found along the edges of most 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.

SHF is located in the Bayou Creek watershed within the Four Rivers Basin (Cobb 2009). This area is within the Atlantic and Gulf Coast region for wetland delineations (USACE 2010) and Region 4 of the National Wetlands Inventory (USFWS 2016c). The proposed project area is composed of approximately 496 acres within the SHF facility that are heavily industrialized and approximately 205 acres within the Shawnee East Site that is in mainly agricultural use, with smaller areas of forest and residential use. The project area includes multiple bottom ash impoundments, riverine/stream environments, and freshwater wetlands (Figures 3.13-1 and

3.13-2). Major water bodies or wetland areas surrounding the project area include the Ohio River to the north, Little Bayou Creek to the west, and Metropolis Lake to the north and east. No major wetland areas are located directly adjacent to the Shawnee East Site.

Wetland surveys were completed on the SHF facility and the Shawnee East Site adjoining the southeast border of the SHF property during October and November 2016 (Appendix D). Prior to these surveys, the potential for wetlands on these properties was evaluated by reviewing the USFWS National Wetland Inventory (NWI) Map as shown on Figures 3.13-1 and 3.13-2.

The historic uses of the SHF facility area and the Shawnee East Site were reviewed to determine the potential for past activities to have influenced current site conditions. The Shawnee East Site has been in agricultural use for decades, and a number of small ponds were excavated on the property for prior farm use. The SHF facility has been in industrial and mining use for decades. The NWI and historical information were used in conjunction with a site inspection to identify wetlands on the site and assess their potential jurisdictional status.

Ash Impoundment 2 and the former SWL are bordered on the east by the main coal pile and powerhouse facility, on the north by the Ohio River, on the west by a large forested area adjacent to Little Bayou Creek, and on the south by forested land owned by SHF. Drainage on the facility generally flows to the northwest toward the ash impoundments and south to Little Bayou Creek. None of the property is designated as being within the 100-year floodplain.

The majority of the Shawnee East Site has been previously disturbed by farming. The agricultural land on the site was not cultivated in 2016 and has grown up in weeds and grass that have been bush-hogged. Aerial survey and site investigation indicated that the agricultural land was cultivated in 2015, when the area was planted in corn. Drainage on the property flows generally to the west and south to Little Bayou Creek (Figure 3.6-1). The eastern and northern sides of the property drain east to a small unnamed tributary of the Ohio River. None of the property is designated as being within the 100-year floodplain associated with any waterbody.

The wetlands determination was performed in accordance with the procedures outlined in the USACE Wetlands Delineation Manual (USACE 1987) as well as the regional supplement for the Atlantic and Gulf Coastal Plain Region (USACE 2010). Data were collected to characterize wetland areas in terms of hydrology, soils, dominant plant species, and wetland type on data forms as provided in the Regional Supplement (USACE 2010). In addition, the value of each wetland was scored by using the TVA Rapid Assessment Method (TVA RAM) to assess wetland condition, functional capacity, and quality (Mack 2001). Wetland data forms and TVA RAM forms are provided in the Delineation Report (Appendix D). Wetland boundaries were determined and recorded in the field, with Global Information System (GIS) files generated for each potential wetland area.

Based on the results of the literature review, one natural wetland and numerous ponds were historically associated with the site. Various types of open water wetlands were preliminarily identified by the NWI map; however, these were related to historic use and had been recently modified such that few of these water bodies remain in the study area.

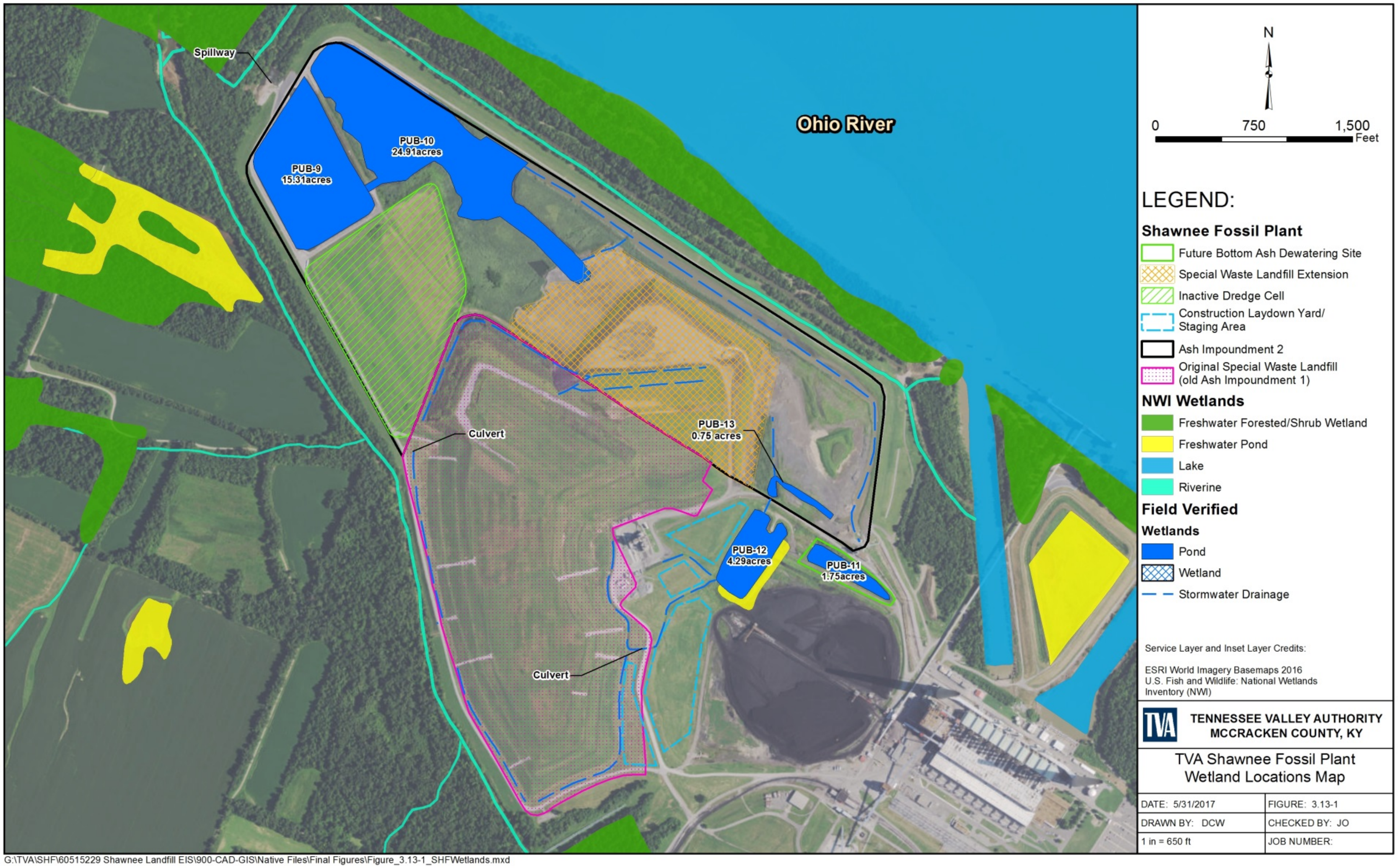


Figure 3.13-1. Wetlands at SHF

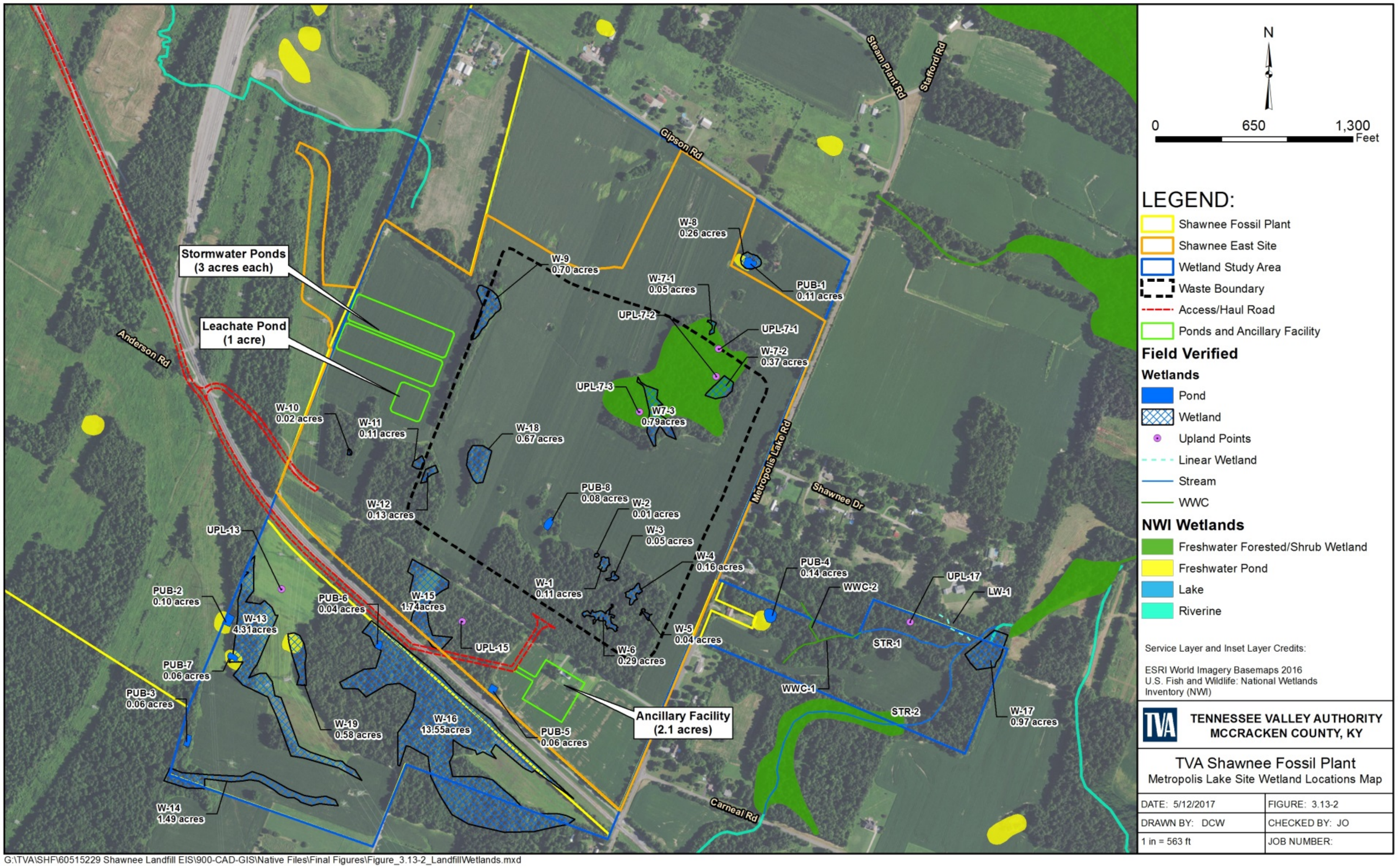


Figure 3.13-2. Wetlands at the Shawnee East Site

During the weeks prior to the field surveys in October/November 2016, very little rainfall had occurred, and no rain fell during the survey. The entire site was walked to determine if wetlands were present, particularly along drainage pathways. Wetlands were labeled in the field by using the designation “W” and a number (e.g., W-1). Sixteen wetland areas totaling 5.5 acres were identified within the approximately 205-acre Shawnee East Site (Figure 3.13-2). The identified wetlands included isolated wetlands, forested wetlands, and drainages. Three small farm ponds also are located within or on the perimeter of the Shawnee East Site (Figure 3.13-2). No wetland features were identified within the SHF facility; however, there are five man-made ponds and multiple storm-water features identified on Figure 3.13-1. Brief descriptions of all the identified wetlands and water bodies are provided in Table 3.13-1.

In implementing Section 404 of the Clean Water Act, the USACE has jurisdiction over WOTUS (EPA 1972). Wetlands and water bodies that meet the criteria to be WOTUS are “jurisdictional.” TVA estimated the jurisdictional status of the wetlands and water bodies on each site based on their characteristics and whether they were likely to be considered WOTUS by the USACE. The Louisville District of the USACE visited the site in January 2017 and assessed the jurisdictional status of the 16 wetlands and three ponds located within the footprint of the Shawnee East Site. An approved jurisdictional determination (JD) and a preliminary JD were issued by the USACE in February 2017. The final approved JD was issued in March 2017 and is included in Appendix F. Fifteen wetlands and three ponds in the project footprint area were determined to be isolated, not WOTUS, and, therefore, not jurisdictional. One wetland in the project area (W-9) was identified as jurisdictional; therefore, a permit would be required for impacts to this 0.7-acre wetland. Table 3.13-1 summarizes the characteristics and estimated or determined jurisdictional status of the wetlands and water bodies in the SHF facilities area (Figure 3.13-1), the Shawnee East Site, and the portions of the survey area outside the project footprint (Figure 3.13-2).

Table 3.13-1. Wetlands and Water Bodies Identified for the SHF Project Areas

ID	Wetland/Water Body Type[1]	Area/Length	Potential Jurisdictional Status[2]
PUB-1	Pond	0.11 acre	Not WOTUS, isolated farm pond[3]
PUB-2	Pond	0.10 acre	Not WOTUS, isolated farm pond
PUB-3	Pond	0.06 acres	Not WOTUS, isolated farm pond
PUB-4	Pond	0.14 acres	Not WOTUS, isolated farm pond
PUB-5	Pond	0.06 acre	Not WOTUS, isolated farm pond[3]
PUB-6	Pond	0.04 acre	Potential WOTUS, connection to W-16
PUB-7	Pond	0.06 acre	Potential WOTUS, connection to W-13
PUB-8	Pond	0.08 acre	Not WOTUS, isolated farm pond[3]
PUB-9	Pond	15.31 acres	Not WOTUS, Ash Impoundment
PUB-10	Pond	24.91 acres	Not WOTUS, Ash Impoundment
PUB-11	Pond	1.75 acres	Not WOTUS, Ash Impoundment
PUB-12	Pond	4.29 acres	Not WOTUS, Ash Impoundment
PUB-13	Pond	0.75 acre	Not WOTUS, Ash Impoundment
W-1	PFO	0.11 acre	Not WOTUS, isolated[3]

Table 3.13-1. Wetlands and Water Bodies Identified for the SHF Project Areas

ID	Wetland/Water Body Type[1]	Area/Length	Potential Jurisdictional Status[2]
W-2	PFO	0.01 acre	Not WOTUS, isolated[3]
W-3	PFO	0.05 acre	Not WOTUS, isolated[3]
W-4	PFO	0.16 acre	Not WOTUS, isolated[3]
W-5	PFO	0.04 acre	Not WOTUS, isolated[3]
W-6	PFO	0.29 acre	Not WOTUS, isolated[3]
W-7-1	PFO	0.05 acre	Not WOTUS, isolated[3]
W-7-2	PFO	0.37 acre	Not WOTUS, isolated[3]
W-7-3	PFO	0.79 acre	Not WOTUS, isolated[3]
W-8	PFO/PUB	0.26 acre	Not WOTUS, isolated[3]
W-9	PFO	0.70 acre	WOTUS, connected to drainage[3]
W-10	PFO	0.02 acre	Not WOTUS, isolated[3]
W-11	PFO	0.11 acre	Not WOTUS, isolated[3]
W-12	PFO	0.13 acre	Not WOTUS, isolated[3]
W-13	PEM/PFO	4.31 acres	Potential WOTUS, connection to drainage to Little Bayou Creek
W-14	PEM/PFO	1.49 acres	Potential WOTUS, connection to drainage to Little Bayou Creek
W-15	PFO	1.74 acres	Not WOTUS, isolated[3]
W-16	PEM/PFO/PUB	13.55 (10.25) acres	Potential WOTUS, connection to drainage to Little Bayou Creek (4 acres outside of property boundary)
W-17	PEM/PFO	0.97 acre	WOTUS, connected to STR-2
W-18	PFO	0.67 acre	Not WOTUS, isolated[3]
W-19	PFO/PUB	0.58 acre	Potential WOTUS, connection to drainage to Little Bayou Creek
STR-1	Stream	749 feet	WOTUS, connected to NWI stream
STR-2	Stream	2,402.4 feet	WOTUS, connected to NWI stream
LW-1	Linear wetland	300.2 feet	WOTUS, connected to STR-2
WWC-1	Wet-weather conveyance	573.9 feet	WOTUS, connected to STR-1
WWC-2	Wet-weather conveyance	305.5 feet	WOTUS, connected to STR-1

[1] Wetland classifications (Cowardin):
PFO – Palustrine forested
PSS – Palustrine shrub scrub
PEM – Palustrine emergent
PUB – Palustrine unconsolidated bottom
[2] WOTUS – Water of the United States
NWI – National Wetland Inventory
[3] This wetland/water body is within the Shawnee East Site and was evaluated by the USACE. The jurisdictional status shown is based on the USACE jurisdictional determination (USACE 2017). Other features in the study area that lack this footnote for their status were outside the proposed landfill project area and were not included by the USACE in the JD.

3.13.2 Environmental Consequences

3.13.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations at its former SWL and Ash Impoundment 2, and would not cease operations or close either of those facilities. Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF, or haul CCR to an existing permitted landfill. As there would be no changes associated with project actions, wetland features would not be impacted under this alternative.

3.13.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Closure of Ash Impoundment 2 would include moving material from one portion of the impoundment and consolidating it within the former SWL expansion, installation of a geomembrane cover system, and the addition of earthen protective cover with herbaceous vegetation. The open water features within Ash Impoundment 2 are considered SHF treatment systems and are, therefore, excluded from regulation under Section 404 of the Clean Water Act. Temporary laydown areas would be located within the impoundment complex or on already disturbed areas of the SHF property. There are no jurisdictional wetlands within the Ash Impoundment 2/former SWL complex; therefore, permanent direct impacts to jurisdictional wetlands associated with closure of the complex are not anticipated.

Indirect impacts to nearby jurisdictional or non-jurisdictional wetlands could potentially result from the alteration of hydrologic inputs to the wetland system resulting from closure of the ash impoundment. Jurisdictional wetlands adjacent to Ash Impoundment 2 have a hydrology that is dominated by water levels within the adjacent Ohio River. Therefore, any modification of hydrologic inputs from Ash Impoundment 2 is expected to have a negligible effect on those wetlands. Adjacent, non-jurisdictional wetlands (typically small, linear wetlands) that have been perpetuated by lateral movement of water from the impoundment berms (seepage) may be reduced in size or eliminated by reductions in hydrology associated with impoundment closure. This cannot be avoided under closure; thus, under EO 11990, there is no practicable alternative that would avoid impacting such wetlands; however, the impacts are expected to be minor.

The proposed CCR Landfill would be located on the 205-acre Shawnee East Site; field surveys of this site identified a total of 22.4 acres of potential wetlands. Within the footprint of the landfill project area, only 5.5 acres of wetlands were documented (Figure 3.13-2). Of these 5.5 acres, one 0.7-acre wetland (W-9) has been determined by USACE to be jurisdictional and to require a Section 404 permit if impacted. The other 4.8 wetland acres are distributed among 15 small isolated areas that USACE determined are not WOTUS and would not require a permit. TVA would attempt to avoid impacts to these wetlands if possible. However, because the activities involved in the proposed actions (i.e., construction of a landfill and an ancillary facility area) must be in close proximity to each other, there is no practicable alternative to certain activities which would avoid all impacts to wetlands, such as clearing, excavating, and grading land. In such instances where impacts to wetlands cannot be avoided, regulatory requirements associated with the USACE Section 404 permitting program would require mitigation sufficient to offset impacts (EPA 1972). These mitigation measures would be clarified at the end of the consultation with the USACE. With this mitigation performed, only minor impacts to wetlands would be anticipated under Alternative B.

Potential indirect impacts resulting from construction activities at either the closure sites or the Shawnee East Site could include erosion and sedimentation from storm water runoff during construction into offsite or nearby jurisdictional and non-jurisdictional wetlands. Use of BMPs in accordance with site-specific erosion control plans would be implemented to minimize this potential. Such impacts cannot be avoided in association with the closure of Ash Impoundment 2 and the former SWL; consequently, there is no practicable alternative that would avoid impacting such wetlands. Overall, indirect impacts to wetland areas due to construction activities would be minor. Closure of Ash Impoundment 2 and the former SWL and development of the proposed CCR Landfill would be conducted in accordance with EO 11990.

3.13.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

The closure of the former SWL and Ash Impoundment 2 under Alternative C would be the same as that described previously for Alternative B. However, under Alternative C, TVA would transport dry CCR to an offsite landfill for disposal. As under Alternative B, soil from the Shawnee East Site would be removed under Alternative C and transported to the SHF facility for use as borrow material in the closure of Ash Impoundment 2 and the former SWL. The removal of this borrow material potentially would result in impact to wetlands in parts of the proposed area of disturbance within the Shawnee East Site. The impacts associated with Alternative C would be similar to those for Alternative B for the SHF facility. However, impacts associated with disposal of CCR in a permitted landfill would be less than those associated with Alternative B because disposal in an existing, permitted, offsite landfill would not result in additional impacts to wetlands beyond those affected by the removal of borrow material within the proposed onsite landfill property. Accordingly, no significant impacts to wetlands would be anticipated under Alternative C.

3.14 Socioeconomics and Environmental Justice

This section describes the socioeconomic resources in the vicinity of SHF (including the minority and poverty characteristics related to environmental justice) and evaluates the impacts on social and economic resources and environmental justice from the Action and No Action alternatives. Components of socioeconomic resources that are analyzed include population, employment, and income; minority populations and poverty levels are analyzed in regard to environmental justice.

3.14.1 Affected Environment

SHF is located about 10 miles northwest of Paducah, KY. It is surrounded by farmland and forest on the east, south, and west, and the Ohio River runs adjacent to the north side of the plant. Metropolis, Illinois is located across the Ohio River approximately 2.5 miles from SHF.

The former PGDP, which ceased operations in 2013 and is currently being decommissioned by the DOE, is located about 3 miles south-southwest of SHF.

Given the nature of the proposed actions, the potentially affected population for this analysis is defined as the 5-mile radius around SHF. McCracken County in Kentucky and Massac County in Illinois and the states of Kentucky and Illinois are included as appropriate secondary geographic areas of reference. Comparison at multiple scales provides a more effective definition for socioeconomic factors that may be affected by the proposed actions including minority and low-income populations.

Closure of the Ash Impoundment 2 and the former SWL and construction of the proposed CCR Landfill would temporarily result in construction related noise, potential exposure to fugitive dust, and exhaust emissions to those persons proximate to the construction site and haul routes. Therefore, potentially affected communities were defined as any census block group that included the ash impoundment to be closed and any block group adjacent to the proposed CCR Landfill.

3.14.1.1 Demographics

Demographic characteristics of the community within a 5 mile radius of the dewatering facility site are summarized in Table 3.14-1. This community incorporates portions of the surrounding cities and counties which is reflected in the resident population of 14,089. However, McCracken County, Kentucky, (65,545 residents) and Massac County, Illinois (15,148 residents) only represent approximately 1.5 and 0.1 percent of the total populations of Kentucky and Illinois, respectively. Since 2010, the population within the surrounding community has increased by 1.2 percent. During this same period, the states of Kentucky and Illinois experienced small population gains (1.0 and 0.3 percent respectively) (TVA 2016d).

The vast majority (91.6 percent) of people within the surrounding community are white. This statistic is similar to the surrounding counties where white people comprise 85 to 91 percent of the population. Correspondingly, minority populations in the study area are small. Black or African Americans are the predominant minority in the study area representing 5.7 percent of the population. Black or African American populations within the study area are lower than McCracken County, Kentucky (10.8 percent), the State of Kentucky (7.9 percent), and the State of Illinois (14.4 percent), but similar to the percent of Black or African American people in Massac County, Illinois (5.6 percent). Hispanic and Latino ethnic groups are present in the study area, but are below comparative rates for the surrounding counties and states (TVA 2016d).

Table 3.14-1. Demographic Characteristics

	Surrounding Community[3]	McCracken County	Massac County	State of Kentucky	State of Illinois
Population					
Population, 2014 estimate	14,089	65,545	15,148	4,383,272	12,868,747
Population, 2010	13,917	65,565	15,429	4,339,367	12,830,632
Percent Change 2010-2014	1.2%	-0.03%	-1.8%	1.0%	0.3%

Table 3.14-1. Demographic Characteristics

	Surrounding Community[3]	McCracken County	Massac County	State of Kentucky	State of Illinois
Persons under 18 years, 2014	23.1%	22.1%	22.4%	23.2%	23.7%
Persons 65 years and over, 2014	17.3%	17.3%	19.1%	14.0%	13.2%
Minority Population					
White, 2014[1]	91.6%	85.4%	91.1%	87.7%	72.5%
Black or African American, 2014[1]	5.7%	10.8%	5.6%	7.9%	14.4%
American Indian and Alaska Native, 2014[1]	0.2%	0.3%	0.1%	0.2%	0.2%
Asian, 2014[1]	0.6%	0.9%	0.4%	1.2%	4.9%
Native Hawaiian and Other Pacific Islander, 2013[1]	0.00%	0.1%	0.0%	0.0%	0.0%
Two or More Races, 2014	1.7%	2.3%	2.4%	2.0%	2.2%
Hispanic or Latino, 2014[2]	0.5%	2.2%	2.3%	3.2%	16.3%
Income and Poverty					
Housing Units	6,547	31,242	7,093	1,938,836	5,299,433
Median household income, 2010-2014	$41,125	$43,650	$43,092	$43,342	$57,166
Persons below poverty level, 2010-2014	19.3%	17.4%	19.0%	18.9%	14.4%

[1] Includes persons reporting only one race.

[2] Hispanics may be of any race, so also are included in applicable race categories.

[3] 5-mile radius around the proposed alternative development sites (Source: TVA 016d).

Source: USCB 2016a, 2016b, 2016c, 2016d, and 2016e.

3.14.1.2 Economic Conditions

Employment characteristics are summarized in Table 3.14-2. The total employed civilian population within the surrounding community is 5,742. Approximately 8 percent of the labor force in the surrounding community is unemployed, which is comparable to the unemployment rate in McCracken County (7.2 percent), but lower than Massac County (10.7 percent) and the states of Kentucky and Illinois as a whole. Median household income for the surrounding community was $41,125, which is similar to those reported for McCracken and Massac counties and the State of Kentucky. However it is lower than the median household income reported for Illinois (see Table 3.14-1) (TVA 2016d)

The largest percentage of civilian employees in McCracken County are employed in the educational services, health care and social services industries (24.5 percent), followed by retail trade (13.5 percent) and arts, entertainment, recreation, accommodation and food services (11.1 percent). Educational services, health care and social services industries employs the largest percentage of civilian employees in Massac County (25.1 percent), followed by arts, entertainment, recreation, accommodation and food services (12.4 percent) and retail trade (11.4 percent) (United States Census Bureau [USCB] 2016f).

Table 3.14-2. Employment Characteristics

	Surrounding Community[1]	McCracken County	Massac County	State of Kentucky	State of Illinois
Population Over 16 years	11,222	52,679	12,144	3,476,701	10,170,489
Civilian Labor Force	6,242	31,128	6,643	2,063,756	6,701,592
Employed	5,742	28,883	5,930	1,870,879	6,032,031
Unemployed	500	2,245	713	192,877	669,561
Percent of Civilian Labor Force Unemployed	8.0%	7.2%	10.7%	9.3%	10.0%

Source: USCB 2016f
[1]5-mile radius around the proposed alternative development sites (Source TVA 2016d).

3.14.1.3 Community Facilities and Services

Community facilities and services are public or publicly funded facilities such as police protection, fire protection, schools, hospitals and other health care facilities, libraries, day- care centers, churches and community centers. Services available to the communities surrounding SHF include hospitals, fire and emergency services, law enforcement, churches, schools and an airport. All of these community facilities are located greater than 1.0 miles from the proposed project site (TVA 2016d).

3.14.1.4 Environmental Justice

Environmental Justice is 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.

Under EO 12898 (Environmental Justice), federal agencies identified in that EO are to address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. While TVA is not identified in EO 12898 as an agency required to comply with its provisions, TVA nevertheless assesses environmental justice impacts in its environmental reviews as a matter of policy.

The analysis of the impacts of the proposed activities on environmental justice issues follows guidance issued under NEPA by the Council on Environmental Quality (CEQ) (CEQ 1997). The analysis of environmental justice impacts has three parts:

- Identification of the geographic distribution of low-income and minority populations in the affected area;
- An assessment of whether the impacts of the proposed activities would produce impacts that are high and adverse; and
- If impacts are high and adverse, a determination is made as to whether these impacts disproportionately affect minority and low-income populations.

In the event that impacts are significant, disproportionality will be determined by comparing the proximity of any high and adverse impacts to the locations of low-income and minority populations. If the analysis determines that health and environmental impacts are not significant, there can be no disproportionate impacts on minority and low-income populations. Demographic data from census block groups in the potentially affected community (i.e., those within a 5-mile radius), were compared to data for McCracken and Massac counties to determine potential impacts to environmental justice communities.

The CEQ guidance concerning the analysis of environmental justice defines minority as individuals who are members of the following population groups: Black or African American; American Indian or Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; or a race whose ethnicity is Hispanic (CEQ 1997).

Identification of minority populations requires analysis of individual race and ethnicity classifications as defined by the USCB, as well as comparisons of all minority populations in the region. Minority populations exist if either of the following conditions is met:

- The minority population of the surrounding community exceeds 50 percent of the total population.
- The ratio of minority population within the surrounding community is meaningfully greater (i.e., greater than or equal to 20 percent) than the minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ 1997).

Total minority populations (i.e., all non-white racial groups combined and Hispanic or Latino) comprise 8.7 percent of the population of the block groups within the potentially affected community. The minority populations within the surrounding community did not exceed rates for McCracken County (16.6 percent minority) or Massac County (10.8 percent minority) (TVA 2016d).

Low-income populations are those with incomes that are less than the poverty level (CEQ 1997). The 2015 Health and Human Services Poverty Guidelines states that, an annual household income of $24,250 for a family of four is the poverty threshold. For an individual, an annual income of $11,770 or less is below the poverty threshold (TVA 2016d). A low-income population is identified if either of the following two conditions are met:

- The low-income population of the surrounding community exceeds 50 percent of the total population.
- The ratio of low income population within the surrounding community significantly exceeds (i.e., greater than or equal to 20 percent) the appropriate geographic area of analysis.

Approximately 19 percent of persons within the potentially affected community are living below the poverty threshold. The low-income populations within these block groups did not significantly exceed corresponding rates for McCracken County (17.4 percent) or Massac County (19.0 percent) (TVA 2016d).

However, the total low-income population exceeded 50 percent of the total population in one of the block groups included within the potentially affected community, and, persons in this block group should be considered as a low-income population subject to environmental justice considerations. This block group is located in the city of Metropolis (TVA 2016d).

3.14.2 Environmental Consequences

3.14.2.1 Alternative A – No Action

Under the No Action Alternative, no construction activities would be undertaken by TVA and generated CCR would continue to be stored in Ash Impoundment 2 and the former SWL. There would be no project related impacts to low-income or minority populations under this alternative. Under the No Action Alternative, current employment trends in the area would likely continue with most of the employment in the existing economic sectors of retail trade and government. There would be no new job creation. Therefore, no impacts to socioeconomics or to environmental justice would be anticipated under the no action alternative.

3.14.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

3.14.2.2.1 Demographic and Employment Impacts

The onsite construction workforce is estimated to be 35 workers during the construction period (estimated to be no more than three years). These workers would be drawn from the labor force that currently resides in the study area. After construction is complete, up to five workers would be hired full-time to maintain and operate the new CCR facility, which would create a negligible positive impact to employment in the region.

3.14.2.2.2 Economic Impacts

Potential economic impacts associated with the proposed project relate to direct and indirect effects of the closure of Ash Impoundment 2 and the former SWL and the construction and long-term operation of the proposed landfill. Construction activities would entail a temporary increase in employment and associated payrolls, the purchases of materials and supplies and procurement of additional services. Capital costs associated with the proposed actions would, therefore, have direct economic benefits to the local area and surrounding community. Revenue generated by sales tax collected from purchases by new workers would benefit the local economy. Additionally, some beneficial secondary impacts to the economy are also expected in conjunction with the multiplier effects of construction activities. For example, the hospitality and service industries would benefit from the demands brought by the increased construction work-force. However, given the relatively small magnitude of the anticipated construction and workforce, this beneficial impact is considered to be minor as well as temporary. Long-term direct and indirect beneficial impacts related to employment would be negligible given the anticipated size of the permanent workforce.

3.14.2.2.3 Community Facilities and Services

Direct impacts to community facilities occur when a community facility is displaced or access to the facility is altered. Indirect impacts occur when a proposed action or project results in a population increase that would generate greater demands for services and affect the delivery of such services. There are no direct impacts to community services associated with any of the alternatives as there are no community facilities within a mile of the proposed project site. In addition, the temporary construction work can be drawn from the local workforce and the operation of the proposed CCR Landfill would require only a small increase in full-time employment (up to five workers). Therefore, there would be no change to the current demand for services in the region and the closure of Ash Impoundment 2 and the former SWL and the construction and operation of the proposed new CCR landfill would not cause any impacts to community facilities and services.

3.14.2.2.4 Environmental Justice

A low-income population subject to environmental justice consideration was identified in a block group within the surrounding community. This block group is located within the City of Metropolis, roughly 3 miles east of the project sites. Implementation of Alternative B would have minor to no impact on the region's economy, air quality, and other resource areas. Although scenic values may be negatively impacted in the vicinity of the proposed CCR Landfill, the environmental justice community in Metropolis would not be able to see these impacts because of distance and intervening structures and vegetation. Therefore, the environmental justice community in Metropolis would not be impacted. No disproportionate impacts to disadvantaged populations are expected to occur.

3.14.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

3.14.2.3.1 Demographic and Employment Impacts

There would be no impact on demographic characteristics of the study area under this alternative. The closure activities would have similar impacts to demographics as under Alternative B. The offsite landfill is already permitted and constructed and therefore no temporary workforce would be needed for landfill construction and operation. No additional permanent workers would be employed during operation of the landfill in association with the added transportation distance. Therefore, no long-term or significant impacts to local demographics are expected.

3.14.2.3.2 Economic Impacts

Potential economic impacts associated with this alternative would be similar to those described for Alternative B. However, positive economic impacts would be much smaller as no construction-related direct and indirect beneficial impacts would be realized with respect to the CCR Landfill construction and operation. Revenue generated by income tax and sales tax from new workers associated with the closure activities would benefit the local economy. However, given the relatively small magnitude of the anticipated workforce, this impact is considered to be negligible.

3.14.2.3.3 Community Facilities and Services

No displacements would occur under this alternative, and there are no community facilities proximate to the proposed offsite landfill. Access to potential community facilities and services along the haul route would not be anticipated as trucks would be periodic, would be similar in nature to existing traffic along these roadways, and would have only temporary effects on facilities in the vicinity. Therefore, there may be some impact to ease of movement to community facilities proximate to the haul route due to the additional trucks on the roadway transporting CCR to the landfill. However, as noted in Section 3.17 (Transportation), these potential localized impacts are anticipated to be minor. Transport of dry CCR generated at SHF to the Freedom Waste Landfill is expected to be carried out by local contractors, and no significant relocations to the area are anticipated. Therefore, local fire, police, medical or educational services would not be affected.

3.14.2.3.4 Environmental Justice

There would be no direct impact to environmental justice communities under Alternative C. The environmental justice community identified in Metropolis would not be impacted by transportation changes as it is not located along any potential haul road. Air quality, scenic integrity and other resources would not be impacted in this community. Therefore, no impacts to environmental justice are anticipated under Alternative C.

3.15 Natural Areas, Parks, and Recreation

3.15.1 Affected Environment

Natural areas, parks, and recreation areas include sites typically managed and/or used for one or more of the following objectives (TVA 2016b):

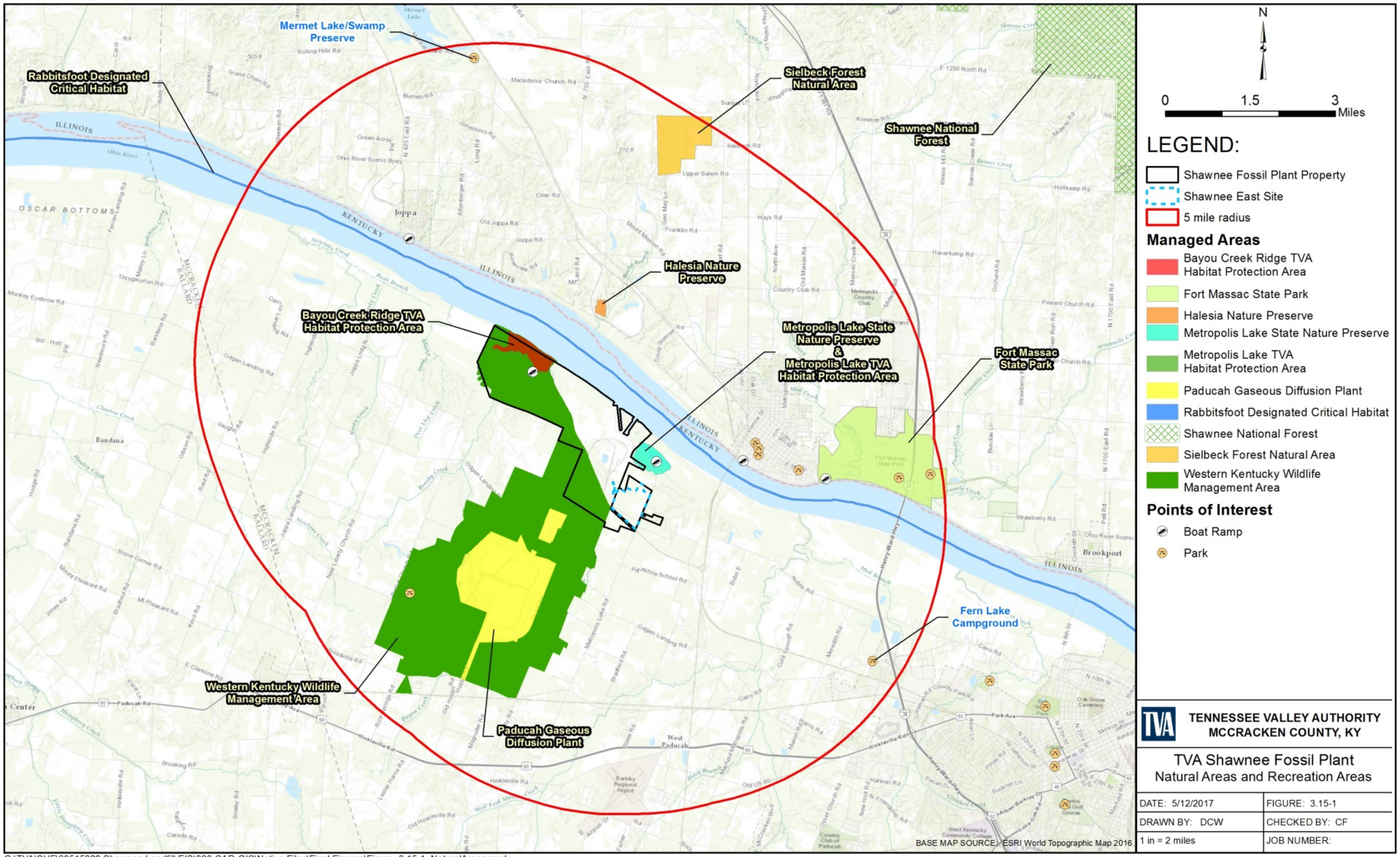
- Recreation – Examples include national, state and local parks and recreation areas; reservoirs (TVA and others); picnic and camping areas; birdwatching areas, trails, and greenways; and TVA small wild areas, day use areas, and stream access sites.
- Species/Habitat Protection – Places with endangered or threatened plants or animals, unique natural habitats, or habitats for valued fish or wildlife populations. Examples include national and state wildlife refuges, mussel sanctuaries, TVA habitat protection areas, and nature preserves.
- Resource Production/Harvest – Lands managed for production of forest products, hunting, and/or fishing. Examples include national and state forests, state game lands and wildlife management areas, and national and state fish hatcheries.
- Scientific/Educational Resources – Lands protected for scientific research and education. Examples include biosphere reserves, research natural areas, environmental education areas, TVA ecological study areas, and federal research parks.
- Scenic Resources – Areas with exceptional scenic qualities or views. Examples include national and state scenic trails, scenic areas, wild and scenic rivers, and wilderness areas.

This section addresses natural areas, parks, and recreation areas located on, immediately adjacent to (within 0.5 miles), or within a 5-mile radius of SHF. A review of the TVA Regional Natural Heritage database in November 2016 indicated three protected areas on or near SHF. The first area, Bayou Creek Ridge TVA Habitat Protection Area (HPA), is located on the SHF property approximately 0.7 miles northwest of the Ash Impoundment 2, and the second area, Metropolis Lake TVA HPA, is located approximately 0.3 miles northeast of the proposed landfill site. According to the database, the Bayou Creek Ridge HPA is one of the finest examples of a high-quality old-growth, mesic bottomland forest remaining in Kentucky. The largest eastern cottonwood (*Populus deltoids*) tree in Kentucky is on the tract, which is dominated by white oak (*Quercus alba*), northern red oak (*Q.rubra*), tupelo (*Nyssa sylvatica*), and swamp hickory (*Carya cordiformis*). The Metropolis Lake HPA is a natural oxbow lake which is known to contain several fish species listed as threatened by the State of Kentucky. The third area is the portion of the Ohio River adjacent to the project area. This area is within the reach of the river that has been designated by the USFWS as critical habitat for the threatened rabbitsfoot mussel (Figure 3.15-1). Further information regarding this species and its critical habitat can be found in Section 3.12 (Threatened and Endangered Species).

Natural areas located farther from SHF in Illinois are the Halesia Nature Preserve, which is across the Ohio River approximately 1 mile north of SHF, and the Sielbeck Forest Management Area, which is approximately 4 miles north of SHF. The Halesia Nature Preserve is a 15-acre tract with wet-mesic floodplain forest, mesic upland forest and dry-mesic upland forest representative of the Bottomland Section of the Coastal Plain Natural Division. The dominant upland trees are oak, hickory, blackberry, and an occasional Kentucky coffee tree, the floodplain forest is silver maple and pecan. This site is home for one of the best stands of silverbell trees in Illinois (Illinois Department of Natural Resources 2016a). The Sielbeck Forest State Natural Area is a relic bottomland hardwood forest and forested swamp which was preserved privately by Ruth and Louie Sielbeck. The Nature Conservancy purchased the tract in 1998 and then sold it to the Illinois Department of Natural Resources. The floodplain forest is dominated by cherrybark oak, sweetgum, and pin oak, the forested swamp is 35 acres dominated by cypress and tupelo. Although there are only two parking areas and no other facilities or trails, hiking, hunting, and fishing are allowed in the forest (Illinois Department of Natural Resources 2016b).

As illustrated on Figure 3.15-1, several public recreation areas are located within 5 miles of the project site. Portions of the WKWMA are on SHF property immediately west and south of the Ash Impoundment 2. The WKWMA extends south from SHF and surrounds the PGDP. The WKWMA consists of lands leased to the KDFWR. Public activities in this area include hunting, horseback riding, hiking, and biking (KDFWR 2016b). This WMA also has a fishing pier and a boat ramp (KDFWR 2016c). The WKWMA allows hunting during the appropriate seasons and has a public skeet-shooting range (KDFWR 2016d).

The Metropolis Lake State Nature Preserve is located adjacent to the eastern SHF property line and 0.3 miles north of the proposed CCR landfill site. The Metropolis Lake State Nature Preserve is owned and managed by the KSNPC. This preserve includes important habitat for rare species and provides recreational opportunities such as hiking and fishing (KSNPC 2016b). There is also a small boat ramp at Metropolis Lake (KDFWR 2016d).



G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Final Figures\Figure_3.15-1_NaturalAreas.mxd

Figure 3.15-1. Natural Areas and Recreation Areas in the SHF Vicinity

Fort Massac State Park is located east of SHF and across the Ohio River in Metropolis, Illinois (approximately 3 miles from the proposed landfill site). This park has been maintained since 1908 and includes an interpretive visitor center and a replica of the original fort. The park also has developed picnic areas, trails, boating access to the Ohio River, and camping and hunting facilities (Illinois Department of Natural Resources 2016c). In addition, there are several municipal parks within the city of Metropolis, Illinois. All of these parks are located approximately 2 miles or more northeast of the proposed landfill site (Google Earth 2016). The cities of Metropolis and Joppa, Illinois, both have public boat ramps on the Ohio River within 5 miles of the SHF proposed project sites (Illinois Department of Natural Resources 2016d).

In addition to the public parks and recreation areas, there are private recreation sites within 5 miles of SHF. The Fern Lake Campground is approximately 5 miles southeast of the landfill site. This park has 60 RV spaces and 10 tent-only spaces. (Good Sam 2016)

3.15.2 Environmental Consequences

3.15.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and not cease operations at its former SWL and Ash Impoundment 2 or close either of those facilities. Additionally, TVA would not construct and operate the proposed CCR Landfill at or near SHF, or haul CCR to an existing permitted landfill. As there would be no changes associated with project actions, there would be no impact to natural areas, parks, or recreation areas under the No Action Alternative.

3.15.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

The closure of Ash Impoundment 2 and the former SWL would occur on TVA property currently used for industrial purposes. Borrow material for the closure would come from the site designated for the new landfill, or from other previously permitted borrow sites. Therefore, these two closures are not anticipated to have direct impacts to nearby natural areas.

Closure of Ash Impoundment 2 will require dewatering; thus, this impoundment will no longer attract and provide man-made habitat for shorebirds or other waterfowl. As a result, individuals of these species would be expected to utilize natural habitats remaining in the vicinity. A relatively small area of habitat would be lost and relatively small numbers of birds would be displaced. This would not have a noticeable effect on populations or result in overcrowding of the extensive, shoreline habitats available in the natural areas in the vicinity of SHF.

Direct impacts also could be associated with construction activities related to closure of the impoundment itself and the transport of borrow material. Fugitive dust, noise, and traffic generated as a result of these activities could have temporary impacts on people who use natural areas, parks, and recreational areas located in the immediate vicinity of the construction site. This would temporarily affect only the north end of the WKWMA. BMPs will be employed to minimize fugitive dust emissions and, thereby, prevent or reduce potential impacts on nearby natural communities. Wildlife that inhabit nearby natural areas (i.e., the WKWMA and the Bayou

Creek Ridge TVA HPA) may be displaced from habitats near roads and construction areas due to traffic and noise. However, extensive habitats are available in adjacent areas that could support the individual animals temporarily displaced. Because these impacts would be temporary and limited to the construction period, BMPs would be used to minimize the effects from fugitive dust, and habitat areas and numbers of people and wildlife affected would be small, the effects of this alternative would be minor and would not substantially impair the use of these resources by people or wildlife.

The construction of an onsite landfill would also occur on TVA property (Shawnee East Site). This property is currently not in industrial use but is adjacent to industrial areas. There are no parks or natural areas on the parcels currently proposed for the new landfill site, and the nearest natural areas are small and located approximately 0.3 miles from the landfill site. Therefore, direct negative impacts to natural areas are not anticipated. As discussed for the closure activities on the SHF facility, indirect impacts to natural areas nearby are possible due to increased traffic, noise, and fugitive dust emissions. Although these effects would occur during the entire time the landfill is operational, the impacts would be minor. The visual intrusion from the construction and operation of a large-scale landfill in a rural area also could be an indirect impact. Landfill activities likely would not be visible from the natural areas in the vicinity but may be visible to those traveling to recreational sites nearby. These impacts could be mitigated by planting a tree screen and the activities' setback from the roadways.

Overall, impacts to natural areas, parks, and recreation areas under Alternative B would be minor.

3.15.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

The closure of the former SWL and Ash Impoundment 2 would be the same under Alternative C as described previously for Alternative B. Impacts to parks and natural areas in the vicinity would be similar to those under Alternative B. However, the disposal of future CCR would occur at an existing offsite landfill. Freedom Waste Landfill in Mayfield, Kentucky is currently an operating, permitted landfill, and it is not near a natural/recreational area. There are several routes available for transporting CCR from SHF to Freedom Waste, one of which passes through Massac, Kentucky (Google Earth 2016). There are no natural or recreational areas which the trucks would pass through on the major road routes available; however, there are parks and other recreational areas nearby (within 0.5 miles). Noise and fugitive dust may temporarily increase in these areas while the trucks are passing by. However, these are major roadways carrying large numbers of vehicles with various loads. Therefore, no significant direct impacts to natural areas are anticipated due to transportation. Consequently, no direct impacts to natural areas, parks, or recreational areas are anticipated from the future addition of CCR to the materials currently disposed of in these landfills. Overall, impacts to natural areas, parks, and recreation areas under Alternative C would be minor.

3.16 Transportation

3.16.1 Affected Environment

SHF is served by highway and railway modes of transportation. Traffic currently generated by SHF is composed of cars, light duty trucks, and medium duty to heavy duty trucks.

Interstate and state highways provide ample access in the immediate vicinity of SHF. Principal access at SHF is via the two-lane Steam Plant Road. From Steam Plant Road, access to Interstate (I)-24 is via Metropolis Lake Road (State Highway [SH] 996), Ogden Landing Road (SH 358), all of which are two-lane roadways. The connection from SH 358 to I-24 is SH 305, a four lane road. The intersection of SH 305 and I-24 is approximately 6 miles southeast, 8 miles by road.

TVA has secured permission from McCracken County for the closure of the portion of Anderson Road which crosses the Shawnee East Site. TVA is also currently improving an existing access road from the main SHF plant area to the Shawnee East Site to provide secure access to this property. This gravel access road is located southwest of the coal pile, along the existing train tracks and connects to the former Anderson Road.

Freedom Waste Landfill is located near Mayfield, Kentucky, in neighboring Graves County. The most likely CCR haul route under Alternative C is shown in Figure 2.1-7. Because trucks may be required to take different routes for various reasons (road construction, traffic accidents, etc.) and because transportation impacts could be experienced along the full length of the haul route between SHF and the Freedom Waste Landfill, a 30-mile radius has been determined to define the affected environment for Alternative C. Within a 30-mile radius of SHF, the transportation network is extensive and contains hundreds of miles of roads and bridges, rail lines and navigable waterways. Transportation resources within 30 miles include I-24, I-69, I-57, US 60, US 62, US 68, US 641, and US 45 (Google Earth 2016). The proposed haul routes are assumed to incorporate a mix of local, state and interstate roadways.

The Kentucky Transportation Cabinet completed a study in 2014 analyzing the benefits and feasibility of constructing a connector from I-24 to the industrial Ohio River Megapark located approximately 2 miles southeast of SHF. To the west of the intersection with State Highway 305, SH 358 is a two-lane road with 10-foot wide lanes. The truck weight class of most of the roads in the connector study area was 44,000 pounds. SH 358 is designated for 80,000 pounds. I-24 is the only designated truck road in the area. Although the study area does not encompass SHF, generally all the roads in the area were operating at Level of Service (LOS) A (free-flow conditions, high freedom to maneuver, and little or no delay). As this area is closer to Paducah and I-24, and should be more heavily travelled than roads closer to SHF, it is reasonable to assume that the roads closer to SHF would also operate at LOS A. The study included future west extensions which could eventually connect to SHF (Kentucky Transportation Cabinet 2014). This connector has been funded and is in the design phase (Kentucky Transportation Cabinet 2016).

The 2015 annual average daily traffic (AADT) on the roadways in the immediate vicinity of SHF for SH 1420, SH 996 and SH 358 are indicated in Table 3.16-1. Also included are portions of US 45 in Graves County.

Table 3.16-1.
Average Daily Traffic Volume (2015) on Roadways in Proximity to SHF

Roadway	Average Annual Daily Traffic (AADT)
SH 1420 between I-24 and SH 996	382
SH 996 between SH1420 and SH 358	1085
SH 358 between SH 996 and SH 1321	812
SH 358 between SH 305 and SH 996	2727
SH 305 between SH 358 and I-24	7080
US 45 from the county line to SH 849	10276
US 45 between Hickory and Mayfield	333
US 45 between SH 849 and SH 408	104

Source: Kentucky Transportation Cabinet 2015a, 2015b, 2015c

3.16.2 Environmental Consequences

3.16.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations at its former SWL and Ash Impoundment 2 and not cease operations or close either of those facilities. No changes to transportation in the area would occur. Therefore, no impacts to transportation would occur under the No Action alternative.

3.16.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

During closure and construction activities, increases in local traffic along the local roadways could occur. Traffic generated would consist of the construction workforce, and shipments of goods and equipment to the site to be used in the closure and construction activities. Minor temporary negative impacts to traffic may occur during construction as a result of traffic increases. It is likely these impacts would occur primarily during the peak morning and evening commute times. Once construction is complete, traffic patterns should return to current conditions. Therefore, minor and temporary impacts to transportation would occur under Alternative B in association with the closure activities.

The access road will connect the SHF facility with Anderson Road and would provide a direct transportation route from the facility to the Shawnee East Site. Under the proposed action this gravel access road would be upgraded to a paved haul road. Hauling of borrow material from the landfill site to Ash Impoundment 2 for the closure activities and hauling CCR from SHF to the CCR Landfill would take place entirely on TVA property along this road. Therefore, no impacts to traffic due to hauling activities or operations of the proposed CCR Landfill would occur.

3.16.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Under Alternative C, TVA would close Ash Impoundment 2 and the former SWL and transport CCR to the offsite Freedom Waste Landfill. During closure activities, impacts to traffic would be similar to those under Alternative B. Borrow materials for the Ash Impoundment 2 closure would still be gathered from the Shawnee East Site as in Alternative B. All borrow material hauling would still take place on TVA property. Indirect, minor and temporary increases in traffic could occur due to an increased workforce at SHF.

As CCR would be transported from SHF to the Freedom Waste Landfill on local roads, direct impacts to traffic could occur. There are several potential routes, and the final route has not been decided. It is assumed that the trucks would travel along SH 996 to SH 358 to SH 305 to I-25 and the US 45. Between 190 and 350 trucks per day would travel the approximately 30 miles from SHF to the offsite landfill. Table 3.16-2 presents traffic counts on some of these roads and calculates the percentage of increase the CCR hauling would contribute.

Table 3.16-2. The Increase in Number of Vehicles and Percent Increase for a Selection of Local Roads

Roadway	AADT	AADT with CCR hauling	Percent increase
SH 1420 between I-24 and SH 996	382	582	52
SH 996 between SH1420 and SH 358	1085	1285	18
SH 358 between SH 996 and SH 1321	812	1012	24
SH 358 between SH 305 and SH 996	2727	2927	7
SH 305 between SH 358 and I-24	7080	7280	2
US 45 from the county line to SH 849	10276	10476	1
US 45 between Hickory and Mayfield	333	533	60
US 45 between SH 849 and SH 408	104	304	192

The percentages of increased traffic vary from 192 percent to 1 percent. The largest increases are along short stretches or small roads. Larger roads with longer stretches would easily accommodate the increased truck traffic. Smaller and shorter roads would be more heavily impacted. TVA would likely chose a route that does not include roads that might be highly impacted, especially as smaller roads may not be able to accommodate the larger vehicles at all. With careful route planning and the use of larger roads when possible, congestion impacts would be minimized. Additionally, the increase in vehicles on the local roads is not anticipated to cause negative impacts to traffic as the roads are currently functioning at LOS A and an increase in up to 200 vehicles should not cause LOS to decline.

Some additional wear on the roads due to increased heavy vehicle travel could occur. The majority of the haul route is along major roadways designed for vehicles of varying sizes and weights. The trucks hauling CCR material to the offsite landfill would be within standard parameters for such roadways. Smaller roads not rated for truck traffic would be avoided. In the future, Kentucky Transportation Cabinet would continue to assess road upgrade and repair needs as they arise.

There is the potential for increases in crash rates along haul routes due to increased heavy truck traffic (TVA 2016b). This increase would have more of an impact on smaller rural roads, which, as described above, TVA would seek to avoid.

Overall, minor temporary negative indirect impacts to traffic in the area may occur during the closure of Ash Impoundment 2 and the former SWL. Moderate negative impacts to traffic flows, accident rates and road conditions could occur during transport of the CCR to the offsite landfill.

3.17 Visual Resources

3.17.1 Affected Environment

This assessment provides a review of the visual attributes of existing scenery, along with the anticipated attributes resulting from the proposed actions. Visual resources are evaluated based on a number of factors including existing landscape character and scenic integrity. Landscape character is an overall visual and cultural impression of landscape attributes and scenic integrity is based on the degree of visual unity and wholeness of the natural landscape character. The varied combinations of natural features and human alterations both shape landscape character and help define their scenic importance. The subjective perceptions of a landscape's aesthetic quality (scenic attractiveness) and sense of place is dependent on where and how it is viewed.

The visual landscape of an area is formed by physical, biological and man-made features that combine to influence both landscape identifiability and uniqueness. Scenic resources within a landscape are evaluated based on a number of factors that include scenic attractiveness, integrity and visibility. Scenic attractiveness is a measure of scenic quality based on human perceptions of intrinsic beauty as expressed in the forms, colors, textures and visual composition of each landscape. Scenic integrity is a measure of scenic importance based on the degree of visual unity and wholeness of the natural landscape character. The varied combinations of natural features and human alterations both shape landscape character and help define their scenic importance. The subjective perceptions of a landscape's aesthetic quality and sense of place is dependent on where and how it is viewed.

Scenic visibility of a landscape may be described in terms of three distance contexts: (1) foreground, (2) middleground and (3) background. In the foreground, an area within 0.5 miles of the observer, individual details of specific objects are important and easily distinguished. In the middleground, from 0.5 to 4 miles from the observer, object characteristics are distinguishable but their details are weak and tend to merge into larger patterns. In the distant part of the landscape, the background, details and colors of objects are not normally discernible unless they are especially large, standing alone, or have a substantial color contrast. In this assessment, the background is measured as 4 to 10 miles from the observer. Visual and aesthetic impacts associated with a particular action may occur as a result of the introduction of a feature that is not consistent with the existing viewshed. Consequently, the character of an existing site is an important factor in evaluating potential visual impacts.

For this analysis, the affected environment is considered to include the proposed project areas, and encompasses both permanent and temporary impact areas, as well as the physical and natural features of the landscape. The Ash Impoundment 2 and former SWL project area is located entirely within the existing SHF, in an already industrial area. The proposed CCR Landfill area is also on TVA property, near the SHF powerhouse to the southeast (Shawnee East Site). This site is not in an industrial area and is adjacent to agricultural and residential properties. The surrounding topography is predominately flat as the area is in the historic floodplain for the Ohio River. Mostly forested, undeveloped or agricultural lands around SHF are visible from the project areas. Low-density residential areas with similar topographical relief are located southeast and immediately adjacent to the Shawnee East Site.

The proposed Ash Impoundment 2 and former SWL closures would be constructed within the SHF site boundary on land that is currently in industrial use. Photo 3.17-1 shows a portion of Ash Impoundment 2. Photo 3.17-2 shows the former SWL. The Impoundment and landfill are located on the northwest corner of the SHF property. The view is industrial in nature but is not visible to the general public. The trees along the Ohio River screen the area from recreational boaters and trees also line the western property boundary. There are no residences or sensitive observers in the immediate vicinity. Due to the height of the existing landfill, some observers on the Ohio River and in the general project vicinity might be able to see a large grassy mound adjacent to the SHF powerhouse.

The proposed CCR Landfill would be constructed on TVA property to the southwest of the powerhouse adjacent to Gipson Road. Photo 3.17-3 shows a portion of the landfill project area. Most of the project area is an agricultural field. There are residents in the immediate vicinity, however, and these observers would likely be able to see activities at the landfill site (Photo 3.17-4).

Other than nearby residences, the closest sensitive visual receptors to the SHF projects sites are Metropolis Lake State Nature Preserve, which is located less than 0.5 miles north of the proposed landfill site; Hopper Cemetery, which is located approximately 0.5 mile to the northwest of the proposed CCR landfill; and the WKWMA, immediately adjacent (south and west) to the Ash Impoundment 2 site.

3.17.2 Environmental Consequences

3.17.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and not cease operations at its former SWL and Ash Impoundment 2 or close either of those facilities. Additionally, TVA would not construct and operate the proposed CCR Landfill at SHF, or haul CCR to an existing permitted landfill. Direct impacts to visual resources under Alternative A are not anticipated.

Photo 3.17-1. Ash Impoundment 2

Photo 3.17-2. Existing SWL

Photo 3.17-3. A portion of the proposed CCR landfill project area

Photo 3.17-4. Residences near the Shawnee East Site

3.17.2.2 Alternative B – Construction of Onsite Landfill and Closure of Former Special Waste Landfill and Ash Impoundment 2

Under Alternative B, during the construction phase of the proposed closure of the Ash Impoundment 2 and the former SWL, direct negative impacts to visual resources are not anticipated as this portion of the facility is not visible from any sensitive receptors and has existing vegetative screening. Indirect negative impacts could occur due to slight visual discord from the existing conditions because of an increase in personnel and equipment on roadways in the area. Impacts from additional vehicular traffic are expected to be negligible as the roads are already predominately used for industrial activity. This small increase would be temporary and only last until all closure activities have been completed. Additionally, since the scenic attractiveness of the project site is already of minimal quality, the construction activity is not anticipated to result in a change in the scenic quality.

The closure facilities would primarily be seen by employees and visitors to SHF. The visual characteristics would not be significantly different from the current views. With re-vegetation post-closure, the scenic quality could be enhanced as the landfill and ash impoundment would resemble a mowed field and hill post closure. Overall, impacts to visual resources with respect to closure activities would be negligible.

Views of the closure facilities, to and from sensitive visual receptors in the vicinity, including the Ohio River and Metropolis Lake State Nature Preserve would remain the same post construction. Due to the forested land cover at the preserve and surrounding SHF, the closure sites are not expected to be visible to recreational users from most areas in the Preserve. Overall, the area would not be expected to be discernible from the existing scenery due to the distance of the viewing receptors.

Direct negative impacts to visual resources due to the construction of the proposed CCR Landfill to the southwest of the powerhouse would occur. The property is currently mostly agricultural fields, which would be replaced by an active industrial landfill with large earthmoving equipment. Existing vegetation and structures would be removed, disturbing the rural aspect of the site, and distinguishing it from the current surroundings. Although the site is adjacent to visually industrial aspects, they are not highly visible from the new landfill site or its immediate vicinity. Observers in the immediate area would be impacted both on roads and at residences and recreational areas. Due to the low-density of residents and the adjacent industrial aspects, this negative impact would be considered moderate. TVA may mitigate these impacts with vegetative screening and setbacks; however, impacts could still be considered moderate due to the height and overall size of the proposed landfill.

The visual resources analysis in Appendix E contains a location map showing key observation points around the Shawnee East Site, photographs of the existing viewshed at these observation points, and a series of renderings showing the potential changes to the viewshed resulting from the construction of the proposed CCR Landfill. The proposed CCR Landfill would not be visible from most of the surrounding area due to topography and intervening structures and vegetation. The potential viewshed changes and aesthetic impacts would be highest from the residential areas along Metropolis Lake and Gipson Roads.

From the residences on Metropolis Lake Road, aesthetic impacts would be largely mitigated by the tree buffer TVA would plant around the landfill waste boundary. Residences along Gipson Road would be directly impacted by the alterations in the viewshed. The proposed CCR Landfill would alter the aesthetic agricultural viewshed to an industrial viewshed for these residents. Because of the height of the landfill, the aesthetic impacts would only be partially minimized by the setback distance from the property boundary and the tree buffer. Therefore, overall aesthetic impacts associated with construction and operations of the proposed CCR Landfill would be moderate.

The Ash Impoundment project location would continue to be classified as having common to minimal scenic attractiveness and low scenic integrity. The landscape character of this highly disturbed industrial site would be similar to the existing character. Therefore, visual impacts resulting from implementation of Alternative B at this location would be negligible. The Shawnee East Site would change from an agricultural rural setting to an industrial setting during the life of the landfill. Negative visual impacts during the construction and operation of the landfill would be moderate at locations from where it could be visible along the local roads and from nearby residences. After closure of the landfill these impacts would be lessened due to the vegetative cover and the lack of heavy equipment onsite. However, the visual contrast of a large mound in a flat rural area would still constitute a moderate negative impact to visual resources in the surrounding area.

3.17.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

The closure of the former SWL and Ash Impoundment 2 would be the same under Alternative C as described previously for Alternative B. Impacts to visual resources in the vicinity would be similar to those under Alternative B.

Alternative C would have fewer negative direct impacts to visual resources than those described under Alternative B due to the lack of the proposed CCR Landfill construction. Major changes to the visual environment in the vicinity of the proposed landfill would not occur, though minor changes would occur as a result of use of the site for excavation of borrow material in association with the closure activities. Excavation of borrow material would still change the viewshed for residences along Metropolis Lake and Gipson Roads from agricultural to industrial. However, the excavation activities would occur at ground level and would result in an appearance of bare soil and depressions. This would be a more minor impact than the construction of a landfill under Alternative B because of the lower profile of the changed topography.

As the proposed offsite landfill is already permitted, no changes to visual resources in the vicinity of this site are anticipated. Indirect negative impacts could occur to visual resources in the vicinity due to the additional traffic generated by the necessity of hauling the CCR offsite. More heavy equipment, noise and fugitive dust would be anticipated.

Overall, direct and indirect negative impacts to visual resources in the vicinity of SHF would be minor under Alternative C.

3.18 Cultural and Historic Resources

Cultural resources include prehistoric and historic archaeological sites, districts, buildings, structures, and objects as well as locations of important historic events. Federal agencies, including TVA, are required by the National Historic Preservation Act (NHPA) (16 United States Code [USC] 470) and by the NEPA to consider the possible effects of their undertakings on historic properties. “Undertaking” means any project, activity, or program, and any of its elements, which has the potential to have an effect on a historic property and is under the direct or indirect jurisdiction of a federal agency or is licensed or assisted by a federal agency. An agency may fulfill its statutory obligations under NEPA by following the process outlined in the regulations implementing Section 106 of NHPA. Additional cultural resource laws that protect historic resources include the Archaeological and Historic Preservation Act, Archaeological Resources Protection Act, and the Native American Graves Protection and Repatriation Act.

Section 106 of the NHPA requires that federal agencies 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) and other interested consulting parties, including federally recognized Indian tribes.

Cultural resources are considered historic properties if they are listed or eligible for listing in the NRHP. The NRHP eligibility of a resource is based on the Secretary of the Interior’s criteria for evaluation, which state that significant cultural resources possess integrity of location, design, setting, materials, workmanship, feeling, association, and

a. Are associated with events that have made a significant contribution to the broad patterns of our history; or
b. Are associated with the lives of persons significant in our past; or
c. Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value; or
d. Have yielded, or may yield, information (data) important in prehistory or history. (Andrus 2002)

A project may have effects on a historic property that are not adverse, if those effects do not diminish the qualities of the property that identify it as eligible for listing on the NRHP. However, if the agency determines (in consultation with the SHPO and tribes) that the undertaking’s effect on a historic property within the area of potential effect (APE) would diminish any of the qualities that make the property eligible for the NRHP, the effect is said to be adverse. Examples of adverse effects would be ground disturbing activity in an archaeological site or erecting structures within the viewshed of a historic building in such a way as to diminish the structure's integrity or setting.

Federal agencies must resolve the adverse effects of their undertakings on historic properties. Resolution may consist of avoidance (such as choosing a project alternative that does not result in adverse effects), minimization (such as redesign to lessen the effects), or mitigation. Adverse effects to archaeological sites are typically mitigated by means of excavation to recover the important scientific information contained within the site. Mitigation of adverse effects to historic structures sometimes involves thorough documentation of the structure by compiling historic records, studies, and photographs. Agencies are required to consult with SHPOs, tribes, and others throughout the Section 106 process and to document adverse effects to historic properties resulting from agency undertakings.

3.18.1 Area of Potential Effect

The APE is the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if such properties exist.

Under Alternative A, TVA would continue to manage CCR in Ash Impoundment 2 and the former SWL. Therefore, the APE for Alternative A is the footprint of these features and the associated areas including the Process Water Basin(s) area and laydown yards/staging area, and consists of previously developed and disturbed lands evaluated for cultural resources as part of the *Shawnee Fossil Plan Bottom Ash Process Dewatering Facility Environmental Assessment* (TVA 2016d).

For Alternative B, TVA would close Ash Impoundment 2 and the former SWL in place and construct a new onsite CCR landfill. The archaeological APE is defined as the project footprint and includes two areas within which ground disturbance could occur:

> The footprints of Ash Impoundment 2 and the former SWL which were previously evaluated as part of the *Shawnee Fossil Plan Bottom Ash Process Dewatering Facility Environmental Assessment* (TVA 2016d) evaluation.
>
> The approximately 330-acre area including and surrounding the Shawnee East Site.

The APE for architectural resources includes the immediate project areas, in addition to any areas visually connected to them via viewsheds to and from the project areas, within a 0.8-km (0.5-mile) radius surrounding the project areas. Areas within the survey radius that were determined not to be within view of the planned project areas due to terrain, vegetation and/or modern built environments were not considered part of the architectural APE (Karpynec and Weaver 2017).

For Alternative C, TVA would close Ash Impoundment 2 and the former SWL in place as described under Alternative B, and would utilize the Shawnee East Site for borrow material for the closure activities. New dry CCR would be disposed of at an existing, permitted offsite landfill. The archaeological and historic architectural APE for Alternative C would be the same as the APE for the closure activities under Alternative B. An additional APE at the chosen existing landfill site would be applicable as well; however, as the dry CCR would be disposed of at an already operational and permitted landfill, no additional cultural resources impacts would be anticipated.

3.18.2 Previous Studies

Archaeological resources are identified through Phase I archaeological surveys conducted for compliance with Section 106.

3.18.2.1.1 Ash Impoundment/Former Special Waste Landfill Area

For previous projects at SHF, TVA conducted records searches at the Office of State Archaeology in Lexington, Kentucky and the Kentucky Heritage Council in Frankfort, Kentucky to identify previously recorded archaeological and architectural properties listed on, or eligible for inclusion in the NRHP within the project APE.

For archaeological resources, the Office of State Archaeology site file and database research identified 13 archaeological surveys conducted and 20 previously recorded sites as located within the 1.6 mile buffer surrounding the archaeological APE for the Shawnee Fossil Plan Bottom Ash Process Dewatering Facility EA (TVA 2016d). No previously recorded archaeological sites are located within the APE that includes Ash Impoundment 2 and the former SWL. A Phase I archaeological survey including a pedestrian survey and shovel test probes determined that much of the Dewatering Facility APE had been previously disturbed as the area had been used for waste management areas and coal storage. The survey did not discover any archaeological sites. Based on these results, TVA recommended that no additional archaeological work be conducted within the APE that includes Ash Impoundment 2 and the former SWL.

In conjunction with the project to install and operate selective catalytic reduction and flue gas desulfurization systems on SHF Units 1 and 4, TVA conducted a historic architectural survey of the plant and a half-mile radius APE around the plant (TVA 2014). This survey identified one historic resource, the plant itself, as eligible for listing on the NRHP. The SHPO agreed with this determination by letter dated December 4, 2014. TVA subsequently nominated the plant for the NRHP under Criterion A due to its association with the TVA Steam Plant program and as TVA's first coal-fired steam plant in Kentucky. As part of the SHF Units 1 and 4 project, TVA proposed removal of the 250-foot tall chimneys associated with Units 1 and 4. Consultation between TVA and the SHPO determined this would result in a significant physical effect to original structures and that this effect would be adverse. The SHPO agreed with this finding and entered into a Memorandum of Agreement (MOA) with TVA for the mitigation of the adverse effect. The mitigation required Historic American Engineering Record-equivalent documentation of the plant, preparation of a Kentucky Heritage Council Individual Buildings Survey Form, and preparation of a NRHP Registration form nominating SHF for inclusion in the NRHP (TVA 2014).

In March 2016, an historic architectural survey was conducted to assess potential visual impacts from the proposed process dewatering system construction on the NRHP-eligible SHF. Based on the survey, TVA found that the proposed dewatering facility would have an adverse effect on SHF (TVA 2016d), but that the mitigation measures stipulated by the MOA, and carried out by TVA in 2016, would adequately mitigate this adverse effect. The SHPO agreed with TVA's finding.

3.18.2.1.2 Shawnee East Site

A literature review of Survey Forms and Reports at the Office of State Archaeology in Lexington, Kentucky was conducted in March and September 2016 (Amec Foster Wheeler 2016a). The area of research included the SHF facility, the 330-acre APE including the Shawnee East Site, and a 2-km (1.24-mile) buffer surrounding the SHF facility and the APE for Shawnee East Site. A total of 26 archaeological sites and 15 archaeological surveys have been recorded within the 2-km study buffer. None of the previously recorded archaeological sites or the previously conducted archaeological surveys was located within the current APE. None of the previously recorded archaeological sites was assessed for eligibility for the NRHP.

Three of the previously recorded sites (15McN92, 15McN95, and 15McN96) were historic farms/residences with Euro-American cultural affiliation (Amec Foster Wheeler 2016a).

- Site 15McN92 dates from the mid-nineteenth to mid-twentieth century and was deemed indeterminate for NRHP eligibility due to a lack of information.
- Site 15McN95 dates from the early to mid-twentieth century. This site, according to the survey form, has been extremely disturbed and shows little potential for archaeological deposits. Site 15McN95 does not meet National Register criteria.
- Site 15McN96 dates from the early to mid-twentieth century. This site was listed as an inventory site and was deemed not eligible for NRHP listing because it has little significant research potential.

Fifteen archaeological surveys were conducted within 2 km of the Shawnee East Site APE. Table 3.14-1 presents a summary of these surveys and their findings.

3.18.3 Affected Environment

3.18.3.1 Ash Impoundment 2 and Former Special Waste Landfill

No new studies were undertaken at the Ash Impoundment 2/former SWL project area because the study undertaken with respect to the dewatering facility was considered sufficient for this area. Additionally, both Ash Impoundment 2 and the former SWL are highly disturbed areas and would not likely contain any intact archeological resources.

Evaluation of historic aerial images and maps shows the proposed area for the Process Water Basin(s) and potential laydown/staging yard has been previously disturbed from prior to 1952 and between 1965 and 1975 (Amec Foster Wheeler 2016b). Therefore, no impacts to intact archaeological resources would be anticipated.

3.18.3.2 Shawnee East Site

In March, April, and September 2016, and in February and March 2017, two Phase I archaeological surveys were conducted at the approximately 330-acre APE around the Shawnee East Site. The first Phase I investigation included an approximately 200-acre portion of the Shawnee East Site. The second Phase I investigation included the remainder of the site, the proposed Process Water Basin(s), proposed bottom ash dewatering site, and four potential laydown areas for a total of approximately 99 acres.

During the initial Phase I investigation (March 28–April 2), five previously unrecorded historic archaeological sites (15McN189 – 15McN190), three isolated finds (IF-2, IF-3, and IF-7), and one non-site locale (NS-1) were identified and recorded. After archival research revealed that sites 15McN189 and 15McN190 were owned by free-slaves, remote sensing was conducted at these two sites (April 18 - 20) to determine if subsurface cultural features were present (Amec Foster Wheeler 2016a).

Sites 15McN189 and 15McN190 were the residence/homesteads of the brothers George (15McN189) and Edward (15McN190) Fletcher, both freed slaves. Site 15McN189 dates to the early through middle nineteenth century. According to the remote sensing, the depositional pattern at the site is intact and could be used to interpret the structure and layout of the farmstead. Additionally, a post was identified which could possibly indicate the location of a structure. Due to the presence of a cultural feature (post), an intact deposition pattern, and an association with the neighboring site (15McN190), TVA determined that the site could contain data important to the history of this location and should be considered to have an NRHP eligibility status of “undetermined”. Avoidance or Phase II testing was recommended (Amec Foster Wheeler 2016a).

Site 15McN190 dates to the middle to late nineteenth century. Multiple cultural features, including a narrow ditch that appears to be associated with a structure, a privy, and a cellar were identified. Additionally, site 15McN190 appears to contain a high degree of spatial integrity. Due to the presence of cultural features (privy and cellar), the high degree of spatial integrity, the potential for additional intact deposits, and an association with the neighboring site (15McN189), TVA determined that the site could contain data important to the history of this location and should be considered to have an NRHP eligibility status of “undetermined”. It was also recommended that ground-disturbing activities be avoided at this site (Amec Foster Wheeler 2016a).

Sites 15McN191 and 15McN192 represent late nineteenth to early twentieth century residence/farmsteads and Site 15McN193 represents a twentieth century residence/farmstead. No evidence of intact archaeological deposits was noted in any of the excavations. Due to the lack of evidence of intact cultural deposits, paucity of cultural material recovered, and, in the case of Site 15McN192, apparent disturbances across the site, TVA determined that Sites 15McN191, 15McN192, and 15McN193 are not eligible for listing on the NRHP. No further archaeological was recommended at these sites (Amec Foster Wheeler 2016a).

Three isolated finds (IF-2, IF-3, and IF-7) consisting of chert flakes were identified and recorded. Due to the paucity of material from each isolate, none of the isolated finds is eligible for listing on the NRHP. No additional work was recommended (Amec Foster Wheeler 2016a).

No subsurface artifacts were recovered at the non-site locale (NS-1). Surface artifacts included plastic 2-liter Coke bottles, a football helmet, modern appliance parts, mason jars, and automobile oil filters. No artifacts were collected. No extant architectural remnants or cultural features were identified. Preliminary analyses suggest that NS-1 represents a twentieth century refuse pit/dump. NS-1 is not eligible for listing on the NRHP, and no further work was recommended (Amec Foster Wheeler 2016a).

Based on the results of this phase I cultural resources survey, TVA found that the APE contains two NRHP-eligible archaeological sites. TVA consulted with the SHPO and federally recognized Indian tribes regarding these findings and determinations. The SHPO agreed to the findings and determinations, and no tribe objected.

Subsequently, TVA conducted additional surveys. These included a second archaeological survey, which investigated five additional land parcels that were proposed as additions to the original 200-acre area, and a historic architectural survey of the historic architectural APE. During the second archaeological survey (September 7 and 26-29, 2016), two archaeological sites (15McN194 and 15McN195) and one isolated find (IF-1) were identified and evaluated.

Site 15McN194 is an undetermined prehistoric lithic scatter with a historic incidental inclusion. No subsurface cultural material or features were identified during excavations. Given the amount of material recovered from a disturbed plow zone setting, site 15McN194 is unlikely to yield information that would contribute to the archaeological record of the area. The site is recommended as not eligible for the NRHP and no further work is recommended (Amec Foster Wheeler 2016b).

Site 15McN195 is a small historic artifact scatter from the late 19th century-early 20th century. Historic map research shows an undetermined structure at the location of site 15McN195. At the time of the Phase I survey, a mobile home trailer was situated at the location of the historic undetermined structure. The artifacts collected are not associated with the mobile home trailer and appear to be associated with the undetermined structure shown on the historic maps. The land was owned by several individuals who never resided on the property, and then by two Caucasian farming families for over 150 years. No subsurface cultural features were identified during excavations. Given the insignificant research value based on archival research coupled with the lack of identified cultural features, site 15McN195 is unlikely to yield information that would contribute to the archaeological record of the area. The site is recommended as not eligible for the NRHP and no further work is recommended (Amec Foster Wheeler 2016b).

Isolated Find-1 consisted of four fragments from a domestic stoneware crock. No other cultural material was encountered on the surface or in the associated shovel probes. IF-1 is recommended as not eligible for the NRHP and no further work is recommended (Amec Foster Wheeler 2016b).

Based on this second archaeological survey, TVA finds that no additional NRHP-eligible archaeological sites (other than 15McN189 and 15McN190) are located within the archaeological APE. TVA is currently engaged in consultation with the SHPO regarding these findings. In August 2017, the SHPO concurred with TVA's findings.

The historic architectural survey (Karpynec and Weaver 2017) identified two previously documented architectural resources: the NRHP-listed SHF (MCN-372) and property MCN-13, a one-and-one-half story, hipped-roof house that appears to have been constructed circa 1910. Based on the results of the investigation TVA finds that MCN-372 is ineligible for the NRHP because it fails to exhibit historical or architectural significance, and has lost historic integrity due to modern alterations. The investigation also identified 13 previously undocumented historic architectural resources (MCN-374 through MCN-386) in the APE. TVA finds that all 13 of these resources are ineligible for the NRHP due to their lack of architectural merit and to losses of integrity caused by modern alterations (Karpynec and Weaver 2017). TVA consulted with the SHPO regarding these findings. In August 2017, the SHPO concurred with TVA's findings.

3.18.3.3 Vicinity

The closest NRHP-listed property is the Elijah P. Curtis House in Metropolis, Illinois, approximately 2 miles northeast of the Shawnee East Site APE (NEPAssist 2016). This property is located at 405 Market Street and is also the Massac County Historical Museum. It is listed as significant under the architecture and social history categories (NRHP 2016). Additional cultural resources in the area include Hopper Cemetery, which is located approximately 0.5 mile to the northwest of the Shawnee East Site.

3.18.4 Environmental Consequences

3.18.4.1 Alternative A – No Action

Under the No Action Alternative, TVA would not close Ash Impoundment 2 and the former SWL and would not construct a new onsite CCR Landfill. TVA would continue to manage CCR in its existing impoundment and landfill. Implementing Alternative A would require no new ground disturbance activities or changes to current operations. Therefore, no direct or indirect impacts to cultural resources would occur under Alternative A.

3.18.4.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Closure activities or ground-disturbing activities at the Shawnee East Site are not anticipated to result in any impacts to cultural resources. However, in the event of discovery of unidentified archaeological resources during construction, TVA would cease all construction activities in the immediate area. TVA would contact the SHPO to determine what further action, if any, would be necessary to comply with Section 106 of the NHPA.

While portions of the proposed CCR Landfill may be visible from SHF, the landfill would be consistent in appearance with SHF operations (such as the former SWL). This would not constitute a major change to visual resources (or the viewshed) of the NRHP eligible SHF.

Therefore, no adverse effects to the NRHP-nominated SHF are anticipated as a result of the proposed actions.

Based on the archaeological investigations, TVA has found that the APE contains two archaeological sites (15McN189 and 15McN190) that could be affected by the then-proposed use of the site as a borrow area. TVA proposed to avoid both sites by placing 30-meter (98-foot) buffers surrounding each, marking the buffers on all plans to be used during physical work in the APE, physically marking the buffers with staking and/or reflective flagging tape, and avoiding any ground disturbing activity within the buffers. TVA consulted with the Kentucky SHPO and federally recognized Indian tribes regarding the results of the first Phase I survey. SHPO agreed with TVA's NRHP determinations and proposal for avoidance (by letter dated September 20, 2016) (Appendix F). TVA also conducted a Phase II testing investigation at these sites to fully determine their NRHP eligibility. TVA is consulting with the SHPO regarding the results of the Phase II survey. The consultation should be completed prior to release of the Final EIS.

Due to the distance from the APE, the NRHP listed property (Elijah P. Curtis House) in Metropolis would not be impacted by the proposed actions. Construction activities associated with the closure of Ash Impoundment 2 and the former SWL, and construction and operation activities associated with the proposed CCR Landfill should not be visible from this location, therefore the NRHP-listed property would not be affected. No impacts would be anticipated to the Hooper Cemetery as a result of the proposed actions.

TVA finds that the undertaking would result in an indirect visual effect to SHF, but that the effect would not be adverse. On August 4, 2017 the Kentucky SHPO concurred with TVA's recommendation that there would be no adverse effect to archaeological resources as a result of the proposed actions. On August 31, 2017 the SHPO concurred with TVA's recommendation that there would be no adverse effect to historic properties. On October 9, 2017, after reviewing the results of the Phase II investigations, the Kentucky SHPO re-concurred with TVA's recommendation of no adverse effect. The consultation letters are included in Appendix F of the Final EIS.

3.18.4.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Under Alternative C, impacts to cultural and historic resources would be similar to those under Alternative B. While the proposed CCR Landfill would not be constructed, the site would be utilized as a borrow source for material used to close Ash Impoundment 2 and the former SWL. Therefore, impacts to archaeological resources at the site would be similar to those described for Alternative B.

3.19 Noise

3.19.1 Affected Environment

The area surrounding SHF consists of semi-rural, sparsely populated areas west of Paducah, Kentucky and south of Metropolis, Illinois. The closest homes to the SHF powerhouse are located approximately 2,900 to 3,300 feet southeast of SHF. The closest residences to the proposed CCR landfill are located across Gipson and Metropolis Lake Roads from the site at a distance of approximately 200 feet from the site boundary and 500 feet from the limits of the landfill waste area. Population density within 1 mile of SHF is low.

Noise is unwanted or unwelcome sound 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 (i.e., higher sensitivities would be expected during the quieter overnight periods).

Sound is measured in units of decibels (dB) on a logarithmic scale; therefore, increasing the noise level by 5 dB results in a noise level perceived by the human ear to be twice as loud as the original source. The “pitch” (high or low) of the sound is a description of frequency, which is measured in Hertz (Hz). Most common environmental sounds are a composite of sound energy at various frequencies. A normal human ear can usually detect sounds that fall within the frequencies from 20 Hz to 20,000 Hz. However, humans are most sensitive to frequencies between 500 Hz to 4,000 Hz.

Given that the human ear cannot perceive all pitches or frequencies in the sound range, sound level measurements are typically weighted to correspond to the limits of human hearing. This adjusted unit of measure is known as the A-weighted decibel (dBA). A noise change of 3 dBA or less is not normally detectable by the average human ear. An increase of 5 dBA is generally not readily noticeable by anyone, and a 10 dBA increase is usually felt to be "twice as loud" as before.

To account for sound fluctuations, environmental noise is commonly described in terms of the equivalent sound level, or Leq. The Leq value, expressed in dBA, is the energy-averaged, A-weighted sound level for the time period of interest. The day-night sound level (Ldn) is the 24-hr 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.

Common indoor and outdoor sound levels are listed in Table 3.19-1.

Table 3.19-1. Common Outdoor and Indoor Noises

Common Outdoor Noises	Sound Pressure Levels (dB)	Common Indoor Noises
	110	Rock Band (15 ft)
Jet Fly-over (1,000 ft)		
	100	
Gas Lawn Mower (3 ft)		
	90	Food Blender (3 ft)
Diesel Truck (50 ft)		
	80	Garbage Disposal (3 ft)
Gas Lawn Mower (100 ft)	70	
		Vacuum Cleaner (10 ft) Normal Speech (3 ft)
Heavy Traffic (300 ft)	60	
	50	Dishwasher Next Room
Typical Urban Daytime		
	40	
Urban Nighttime		Library
	30	Bedroom at Night
Rural Nighttime		
	20	Whisper
	10	
	0	Threshold of Hearing

3.19.1.1 Noise Regulations

The Noise Control Act of 1972, along with its subsequent amendments, delegates authority to the states to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. Although there are no federal, state, or local regulations for community noise in McCracken County, EPA guidelines recommend that Ldn not exceed 55 dBA for outdoor residential areas. The EPA noise guideline is considered to be sufficient to protect the public from the effect of broadband environmental noise in typical outdoor and residential areas. These levels are not regulatory goals but are “intentionally conservative to protect the most sensitive portion of the American population” with “an additional margin of safety” (EPA 1974). 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).

3.19.1.2 Background Noise Levels

Noise levels continuously vary with location and time. In general, noise levels are high around major transportation corridors along highways, railways, airports, industrial facilities, and construction activities. Sound from a source spreads out as it travels from the source, and the sound pressure level diminishes with distance. In addition to distance attenuation, the air absorbs sound energy; atmospheric effects (wind, temperature, precipitation) and terrain/vegetation effects also influence sound propagation and attenuation over distance from the source. An individual’s sound exposure is determined by measurement of the noise that the individual experiences over a specified time interval.

Community noise refers to outdoor noise near a community. A continuous source of noise is rare for long periods and is typically not a characteristic of community noise. 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 (EPA 1974). Background noise levels greater than 65 dBA can interfere with normal conversation, watching television, using a telephone, listening to the radio, and sleeping.

3.19.1.3 Sources of Noise

There are numerous existing sources of noise at SHF. Operations at the existing coal plant generate varying amounts of environmental noise. Noise generating activities associated with the existing plant include coal unloading activities, periodic bulldozer operations associated with coal pile management and truck operations, and machine noises associated with power generation. Current ambient noise levels in the vicinity of SHF are not available; however, existing noise emission levels associated with these activities at other TVA coal plants, like Bull Run typically range from 59 to 87 dBA (TVA 2014).

Vehicular traffic is another noise source at SHF. Transportation noise related to activities evaluated in this EIS primarily includes noise from local road traffic; however, there would also be some noise related to rail and barge traffic at SHF[3]. Three primary factors influence road noise generation: traffic volume, traffic speed, and vehicle type. Generally, heavier traffic volumes, higher speeds, and greater numbers of trucks increase the loudness of road traffic noise. Other factors that affect the loudness of traffic noise include a change in engine speed and power, such as at traffic lights, hills, and intersecting roads and pavement type. Road 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 (Federal Highway Administration 2011). Due to the nature of the decibel scale and the attenuating effects of noise with distance, a doubling of traffic will result in a 3 dBA increase in noise levels, which in and of itself would not normally be a perceivable noise increase.

The level of construction noise is dependent upon the nature and duration of the project. There are ongoing construction projects at SHF at various times. Construction activities for most large-scale projects would be expected to 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 will 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 impact to sensitive receptors (residences or other developed sites where frequent human use occurs such as churches and schools).

[3] The mooring cells at SHF are currently leased to other facilities; however, activities at the barge landing would still serve as a noise source at SHF.

3.19.2 Environmental Consequences

3.19.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and not cease operations at its former SWL and Ash Impoundment 2 or close either of those facilities. Additionally, TVA would not construct and operate the proposed CCR Landfill at SHF, or haul CCR to an existing permitted landfill. As no changes to existing noise levels would be anticipated under this alternative, there would be no anticipated noise impacts.

3.19.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

3.19.2.2.1 Construction

Most construction activities would occur during daylight hours on weekdays; however, construction activities could occur at night or on weekends. Construction-related noise would result from the Ash Impoundment 2 and former SWL closures and construction of the proposed CCR Landfill. Construction-related traffic would use Metropolis Lake Road to access SHF, and the access road on SHF property to access the Shawnee East Site. This would result in some temporary construction traffic noise on this roadway.

Construction of the proposed CCR Landfill would generate noise from equipment. As illustrated in Table 3.19-2, typical noise levels from construction equipment are expected to be 85 dBA or less at a distance of 50 feet from the construction site. These types of noise levels would diminish with distance from the project site at a rate of approximately 6 dBA per each doubling of distance. Therefore, noise would be expected to attenuate to the recommended HUD noise guideline of 65 dBA at approximately 500 feet, and to the recommended EPA noise guideline of 55 dBA at approximately 1,600 feet. However, this distance could be shorter in the field as objects and topography would cause further noise attenuation. The nearest noise sensitive receptors (single family residences) are between 2,900 and 3,300 feet from the source of noise at the existing SHF facility and would not be expected to be affected by construction activities on the SHF site.

Table 3.19-2. Typical Construction Equipment Noise Levels

Equipment	Noise Level (dBA) at 50 ft	Equipment	Noise Level (dBA) at 50 ft
Dump Truck	84	Backhoe (trench)	80
Bulldozer	85	Flatbed Truck	84
Scraper	85	Crane (mobile)	85
Grader	85	Generator	82
Excavator	85	Air Compressor	80
Compactor	80	Pneumatic Tools	85
Concrete Truck	85	Welder/Torch	73
Boring-Jack Power Unit	80		

The nearest residences to the Shawnee East Site are across Gipson Road and Metropolis Lake Road from the project site. Excavation for borrow material may occur up to the Shawnee East Site boundary. The waste storage area would be set back from the road by at least 200 feet on the sites of the property near these roadways. Therefore, these residences are located between 200 and 500 feet from the source of noise at the proposed landfill site. At these distances noise levels would not attenuate to below 65 dBA during construction activities. Elevated noise would occur during daylight hours and would be temporary during construction activities. The elevated noise levels would be detectable at the nearby residences, but would not be high enough to cause health concerns. The tree buffer planted along all landfill borders would help to attenuate construction noises. Additionally, use of BMPs to maintain construction equipment would ensure vehicles are in proper running condition to prevent unnecessary noise increases. Therefore, although noise generated by construction activities would not attenuate to levels set by HUD and EPA at nearby receptor sites, the impacts associated with those elevated noise levels would be minor to moderate due to distance, timing, and the temporary nature of the noise producing activities.

During construction activities, most construction traffic would travel between the SHF facility and the Shawnee East Site along the internal access/haul road, noise from this road would not be significant to the residents in the area. The residences along Gipson Road and Metropolis Lake Road may experience small increases in noise levels during construction from an increase in construction-related vehicles along these roadways (construction worker vehicles and some construction equipment); however, these increases would be temporary and would occur primarily during the day during the morning and evening commute hours. The residences range from 60 feet to 400 feet from the edge of the pavement. The marginal increases in construction-related traffic along Steam Plant Road and Lake Metropolis Road would pose only a minor and temporary impact in noise levels. Therefore, the noise levels generated by construction-related traffic would be minor and temporary.

3.19.2.2.2 Operation

Minimal noise would be produced at Ash Impoundment 2 and former SWL sites once closure is complete. Activities which would produce noise would be mowing and other minor maintenance activities. These noise levels would not cause increases to surrounding noise levels.

Noise produced by operations at the proposed CCR Landfill would be below 85 dBA. As discussed previously, the nearest noise sensitive receptors (single family residences) are between 200 and 500 feet from the source of noise at the proposed landfill site. Noise produced during operations would be concentrated primarily within the waste disposal area of the site which is set back approximately 200 feet from the local roads. It is possible that noise produced during landfill management procedures would not attenuate to levels set by HUD and EPA at the nearby residences, at least during periods when operations were closest to the site boundaries. The tree buffer planted around the site would help to attenuate the noise. The noise would occur primarily during daylight hours. Noise impacts from operations at the proposed CCR Landfill would be minor to moderate, but they would be temporary as operations activities would periodically move to different locations on the site.

Due to the use of the access/haul road, the noise generated by the transportation of CCR to the landfill would not introduce any new sources of noise that would have a noticeable effect on current noise levels from plant operations and would have no effect on offsite noise levels.

3.19.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

3.19.2.3.1 Construction

The noise impacts associated with the facility closures would have the same impacts as Alternative B as it relates to the closure of the former SWL and Ash Impoundment 2. Construction activities would include the excavation of borrow materials from the Shawnee East Site for the closure activities. Therefore, construction related noise levels under Alternative C would be similar to those described under Alternative B.

3.19.2.3.2 Operation

Under Alternative C, the dry CCR would be transported to the selected offsite third-party landfill approximately 30 miles away via truck. The noise levels from transporting CCR to the offsite facility would result in additional traffic noise along Metropolis Lake Road as compared to Alternative B. However, Alternative C would not create noise levels above 85 dBA. Therefore, noise impacts from operations activities would be anticipated to be minor.

3.20 Solid Waste and Hazardous Waste and Hazardous Materials

3.20.1 Affected Environment

3.20.1.1 Solid Waste

Solid waste consists of a broad range of nonhazardous materials including refuse, sanitary wastes, contaminated environmental media, and scrap metals along with nonhazardous wastewater treatment plant sludge, air pollution control wastes, industrial waste, and other materials (solid, liquid, or contained gaseous substances). CCR are regulated as solid waste, a nonhazardous industrial waste, by the EPA. Subtitle D of the RCRA and its implementing regulations establish minimum federal technical standards and guidelines for management of nonhazardous solid waste. States are primarily responsible for planning, regulating, implementing, and enforcing solid waste management. In Kentucky, solid waste is regulated by the Energy and Environment Cabinet, within the Division of Waste Management. The State of Kentucky considers utility wastes (fly ash, bottom ash, scrubber sludge) a special waste as it is high volume and low hazard. Generators of special wastes are required to register with the Energy and Environment Cabinet and are subject to the provisions of Kentucky Revised Statutes § 224.46-510 (Kentucky Assembly 2008).

3.20.1.2 CCR Rule

With the issuance of its CCR Rule on April 17, 2015, EPA finalized national regulations providing comprehensive requirements for the safe disposal of CCR from coal-fired power plants. EPA issued regulations, including requirements for composite liners, groundwater monitoring, structural stability requirements, corrective action, and closure/post-closure care.

EPA determined that compliance with these requirements would ensure that CCR management activities would "not pose a reasonable probability of adverse effects on health or the environment." 80 Federal Register 21468 (40 CFR 257.50(a)). Kentucky regulations state that the design of CCR landfills must adhere to those established in the federal CCR Rule (Kentucky Assembly 2016). TVA's compliance with the CCR Rule is expected to adequately protect human health and the environment.

3.20.1.3 Hazardous Materials

Hazardous materials, including hazardous substances and hazardous waste, are defined as any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety, and property. Hazardous waste is listed under RCRA, meeting certain characteristics relating ignitability, corrosivity, reactivity, or toxicity.

Hazardous materials and management of these materials are regulated under a variety of federal laws including the Occupational Safety and Health Administration (OSHA) standards, the Emergency Planning and Community Right to Know Act (EPCRA), and the Toxic Substances Control Act along with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). TVA adheres to these requirements.

Under EPCRA regulations 40 CFR 355, facilities that have any extremely hazardous substances present in quantities above the threshold planning quantity, are required to provide reporting information to the State Emergency Response Commission, local emergency planning committee, and local fire department. Inventory reporting to the indicated emergency response parties is required for facilities with greater than the threshold planning quantity of any extremely hazardous substances or greater than 10,000 pounds of any OSHA regulated hazardous material. EPCRA also requires inventory reporting for all releases and discharges of certain toxic chemicals. TVA applies these requirements as a matter of policy.

The federal law regulating hazardous wastes is RCRA, and RCRA regulations define what constitutes a hazardous waste and establish a "cradle to grave" system for management and disposal of such wastes.

Subtitle C of RCRA also includes separate, less stringent regulations for certain potentially hazardous wastes. Used oil, for example, is regulated differently depending on whether it is disposed of or recycled. Specific requirements are provided under RCRA for generators, transporters, processors, and burners of used oil that are recycled. Universal wastes may be managed in accordance with the RCRA requirements for hazardous wastes or by special, less stringent provisions.

3.20.1.4 Existing SHF Waste Production

SHF utilizes an average of 2.7 million cubic yards of coal per year. Total SHF ash production is estimated to be 490,000 cubic yards per year since the commencement of operations on the scrubbers in October 2017. Since the fly ash/bottom ash split is about 80 percent fly ash and 20 percent bottom ash, approximately 36,000 to 68,000 cubic yards of bottom ash is generated annually. The CCRs generated are currently managed at the former SWL or the ash pond, as a source for beneficial use has not been identified.

TVA pursues beneficial reuse whenever feasible. With the installation of the dry scrubbers at SHF, the plant will no longer produce fly ash as a discrete stream. The fly ash is captured in the baghouse with the dry scrubber product, resulting in one blended material. There is currently no commercial beneficial use for dry scrubber material containing fly ash. Beneficial reuse of bottom ash requires it to be free of mill rejects. The current configuration at SHF does not allow for segregation and would require installation of a separate handling system for the mill rejects. TVA is initiating studies to determine the feasibility of installing systems to handle mill rejects separate from bottom ash.

SHF generates a limited quantity of hazardous waste and is considered a small quantity generator of hazardous waste. Generated waste streams are related to maintenance and testing activities and include small quantities of waste paint, paint chips, solvents, absorbents, abrasive wastes, printed circuit boards, cathode ray tubes, paper insulated lead cable, and liquid-filled fuses along with oily rags and solvent contaminated rags and silver containing wastes from welding. Maintenance activities also generate used oils including pump lube oils, gear box oils, vacuum pump oils, hydraulic oils, and cutting oils in addition to used engine and transmission oils from vehicles and heavy equipment. These used oils are generally recycled.

Limited amounts of universal wastes (mercury containing relays or similar mercury containing equipment, batteries, and lamps) are routinely generated from the plant infrastructure and operations. SHF is considered a small quantity handler of universal wastes. The proper management of these materials/wastes is performed in accordance with established procedures and applicable regulations.

3.20.2 Environmental Consequences

3.20.2.1 Alternative A – No Action

Under Alternative A, TVA would continue current plant operations and would not close either the former SWL or Ash Impoundment 2 nor construct a CCR Landfill at SHF, or haul CCR to an existing permitted landfill. Solid and hazardous wastes generated at SHF would continue to be managed in accordance with established procedures and applicable regulations until capacity to manage CCR produced at SHF is exceeded. Therefore, no impacts to solid or hazardous waste are anticipated under this alternative.

3.20.2.2 Alternative B – Construction of Onsite Landfill and Closure of the Former Special Waste Landfill and Ash Impoundment 2

Under Alternative B, solid and hazardous wastes would be generated from closure activities of the former SWL and Ash Impoundment 2 along with wastes from construction activities at the proposed onsite landfill. Activities under this alternative are centered onsite with closure-in-place for the former SWL and for Ash Impoundment 2, along with construction and operation of the proposed CCR Landfill.

3.20.2.2.1 Construction

The primary potential issues concerning solid and hazardous wastes with respect to the proposed actions are: (1) the potential for increased generation during construction; (2) the potential for increased generation from operation of the proposed action; and (3) the potential for a spill or release during operations or transportation.

Wastes generated during the closure of Ash Impoundment 2 and the former SWL would be similar to those generated during the construction of the proposed CCR Landfill. The primary waste streams resulting from construction would be solid nonhazardous waste along with some nonhazardous liquid waste. During construction, the primary solid nonhazardous wastes generated would be contractor personnel refuse, construction debris, and soils. Anticipated construction debris would include liner scraps, construction rubble, packing material waste, scrap metals and lumber, and empty chemical containers. Additionally, limited quantities of nonhazardous solvents, paints and adhesives, spill absorbent, oil and solvent contaminated rags, and empty containers would be generated during construction. As most excavated soils would be used as borrow and cover material in the Ash Impoundment 2 and former SWL closure process and for the proposed CCR Landfill, these soils would not be considered wastes. In addition, land clearing, grading, and excavation during construction of the proposed CCR Landfill would generate soils and vegetative wastes.

Various hazardous wastes, such as fuels, lubricating oils, solvents, paints, adhesives, compressed gases and other hazardous materials could also be produced during construction. Onsite management of these wastes would be performed in accordance with RCRA requirements and TVA BMPs that implement RCRA regulations and that include additional procedures intended to prevent spills or other releases. Oily wastes generated during servicing of heavy equipment would not be stored onsite, but would be managed by offsite vendors who service onsite equipment using appropriate self-contained used oil reservoirs. Appropriate spill prevention, containment and disposal requirements for hazardous wastes would be implemented to protect construction and plant workers, the public, and the environment.

TVA would manage all solid waste and hazardous wastes generated from construction activities in accordance with standard procedures for spill prevention and cleanup along with waste management protocols in accordance with pertinent federal, state, and local requirements. Therefore, only minimal direct or indirect effects related to solid or hazardous wastes are anticipated from closure activities.

3.20.2.2.2 Operation

Operation of the new CCR landfill under Alternative B would not change the quantity of CCR wastes generated at SHF annually. Under this Alternative, SHF would continue to generate an estimated 490,000 cubic yards per year of ash. This ash consists of fly ash, bottom ash and gypsum wastes from flue gas desulfurization. These are the primary waste streams associated with both the current situation and Alternatives B and C.

Other solid waste streams associated with operation of the proposed landfill would be limited in quantity. Maintenance of the haul road would involve periodic cleaning of roadside ditches to improve or provide drainage. The wastes generated from these activities would consist primarily of vegetative detritus such as tree limbs, leaves, grass, or other vegetation periodically eliminated by herbicide application in accordance with existing practices. Such wastes would also be generated on a periodic basis from maintenance of drainage ditches associated with the landfill run-on/runoff controls. It is anticipated that these wastes would be generated one time per year but the quantities cannot be accurately predicted. These wastes may be composted or disposed of offsite at a Class III or IV landfill.

Periodic clean-out of the storm water basins would result in soils and vegetative wastes. Clean-out of the storm water retention basins is likely to occur only once or twice over the lifespan of the proposed landfill. Each cleanout event would generate a waste volume of approximately 30 to 50 percent of the capacity of the basins. These wastes may be disposed of offsite at a Class III or IV landfill. It may be possible during the operational phase of the proposed CCR Landfill for these wastes to be dried onsite, screened and blended for use in cover soils. However, if any ash has become incorporated in the wastes as a result of incidental losses during transport or from wind dispersal, the material could not be used in the landfill cover.

With the exception of the CCR, the largest solid waste stream that would be routinely generated from operation of the proposed CCR Landfill is leachate wastewater treatment sludge. A leachate management system would be installed at the proposed CCR Landfill. The design requirements for leachate storage and disposal shall incorporate:

1. The estimated volume of leachate to be generated and a proposed system to record actual quantities stored and removed;
2. A schedule of liquid removal;
3. A description of the final treatment and disposal of the liquid stored;
4. A description of the liquid storage facility design;
5. A method to measure the quantity of leachate extracted or removed and disposed;
6. A closure plan for the tanks; and
7. Design criteria to ensure that on-ground, in-ground, underground, and above ground tanks are constructed of materials, and installed in such a manner, that the tank system shall contain the stored liquid for the active life of the site to include closure care. A procedure for periodic testing of the tank system shall be employed to assure the tank system does not leak (Title 401 KAR Chapter 34).

As TVA would follow all regulations regarding leachate at the proposed CCR Landfill, impacts to human and environmental health are not anticipated.

Other solid wastes that would be generated from operation of the proposed landfill include paper and plastics from packaging of maintenance-related materials, small quantities of oils and fuels from spills, small quantities of paints, adhesives, etc. from maintenance. Pumps, valves and controls associated with the leachate management system would require replacement during operations. These components would be managed as solid waste upon replacement.

Various hazardous wastes, such as used oils, hydraulic fluids and engine coolants could be produced during landfill operations. These wastes would be temporarily stored in properly managed hazardous waste storage areas onsite. Appropriate spill prevention, containment and disposal requirements for hazardous wastes would be implemented to protect construction and plant workers, the public and the environment.

There would be a long-term impact on the management of solid wastes at SHF as CCR produced at the facility would be disposed in a new landfill. However, as the SHF would continue to produce ash at the current level, no impacts would occur related to the size of the waste stream. Additionally, CCR would remain on the SHF site and would be monitored and managed by TVA.

3.20.2.2.3 Post-Closure Care of the Ash Impoundment 2, Former Special Waste Landfill, and proposed CCR Landfill

The primary solid wastes that would result during post-closure care are vegetative detritus and soils from maintenance of the road drainage swales, sludge from periodic clean-out of the storm water basins, sludge from leachate treatment and wastes from cleanout of the leachate collection system. The wastes generated from periodic maintenance of the road drainage swales and run-on/runoff controls would consist primarily of vegetative detritus such as tree limbs, leaves, grass or other vegetation periodically eliminated by herbicide application. It is anticipated that these wastes would be generated annually. The storm water basins would need to be dredged periodically during post-closure care. The volume of waste generated from each event would be 30 to 50 percent of the combined capacities of the basins.

The largest volume waste stream that would be generated during post-closure care would be sludge from leachate treatment. Other small volume solid waste streams that would be generated during post-closure care include purge water from groundwater sampling, lubricating oils and filters from construction equipment and pumps associated with the leachate collection system, small quantities of oils and fuels from spills, small quantities of paints, adhesives etc. from maintenance.

TVA would manage all solid waste generated from construction, operation and post-closure activities in accordance with standard procedures for spill prevention and cleanup and waste management protocols in accordance with pertinent federal, state and local requirements. Therefore, no measurable direct or indirect adverse effects related to solid or hazardous wastes are anticipated from closure activities.

3.20.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of Existing Landfill and Ash Impoundment 2

Under Alternative C, closure activities of the former SWL and Ash Impoundment 2 would generate solid and nonhazardous waste along with wastes from construction activities at the proposed offsite landfill. Similar to Alternative B, the proposed ash impoundment closure would result in the generation of some construction-related solid and hazardous wastes. With implementation of the standard procedures for spill prevention and cleanup and waste management protocols in accordance with pertinent federal, state and local requirements, only minimal direct or indirect adverse effects related to solid or hazardous wastes are anticipated from closure activities.

Alternative C would result in similar impacts to waste streams and waste management at the existing landfill location as described under Alternative B.

In addition to closure-in-place of the former SWL and Ash Impoundment 2, under Alternative C, TVA would transport CCR to an existing offsite third-party landfill, the Freedom Waste Landfill. OSHA requirements for workers engaged in excavation activities would be applied. Transport of CCRs would be managed under the requirements set forth under RCRA Subtitle D and in accordance with pertinent state and local requirements. The Freedom Waste Landfill would have the capacity to support disposal of the SHF CCR over the 20 year span of the project at the low end of the anticipated range of CCR generation, or approximately 490,000 cubic tons per year. However, if SHF waste generates CCR at the high end of the anticipated range, or closer to 910,000 cubic tons per year, this would exceed the Freedom Waste Landfill's capacity. Disposal of such quantities of waste from SHF would impact the landfill's capacity for accepting waste from other sources. Therefore, implementation of Alternative B would result in significant impacts associated with solid waste and hazardous wastes.

3.21 Public Health and Safety

3.21.1 Affected Environment

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. OSHA is the main organization protecting the health and safety of workers in the workplaces. The Kentucky Labor Cabinet has adopted federal OSHA standards (KRS 2016). TVA's Safety Standard Programs and Processes would be strictly adhered to during the proposed actions. The safety programs and processes are designed to identify actions required for the control of hazards in all activities, operations and programs. It also establishes responsibilities for implementing OSHA and state requirements.

SHF is surrounded by a chain link security fence, with guarded entrance gates. Population in the immediate area (within approximately 0.5 miles to the south) is very sparse, with only a few dwellings in the vicinity. The WKWMA area is located to the south and west.

The routine operations and maintenance activities at SHF reflect a safety-conscious culture and are activities performed consistent with OSHA standards and requirements and specific TVA guidance. Personnel at SHF 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.

SHF has safety programs and BMPs in place to minimize the potential of safety incidents. These would include but are not limited to such programs as the following:

- Operations and Maintenance Plans
- Hazard Communication
- Contractor Evaluation and Acceptance
- Project Safety Plans
- Emergency Isolation (Lockout/Tagout)
- Personal Protective Equipment
- Hearing Conservation
- Health and Safety Training
- Hazard Analysis
- Management of Change
- Spill and Emergency Response Plan
- Standard Operating Procedures
- Safety Reviews and Compliance Audits
- Training
- Incident Reporting and Investigations

It is TVA policy that contractors have in place a site-specific health and safety plan prior to conducting construction activities at TVA properties. The contractor site-specific health and safety plans address the hazards and controls as well as contractor coordination for various construction tasks. A health and safety plan would also be required for workers responsible for operating the proposed CCR Landfill after construction is complete.

The potential offsite consequences and emergency response plan are discussed with local emergency management agencies. These programs are audited by TVA no less than once every three years and by EPA periodically.

Health hazards may also be associated with emissions and discharges from industrial facilities. At SHF, mitigation measures are implemented to ensure protection of human health, which includes the workplace, public and the environment.

Additionally, wastes generated by operations at SHF can pose a health hazard. Solid wastes, hazardous waste, liquid wastes, discharges and air emissions are managed in accordance with applicable federal, state and local laws and regulations and all applicable permit requirements. Furthermore, waste reduction practices are employed. TVA is committed to complying with all applicable regulations, permitting, and monitoring requirements.

3.21.2 Environmental Consequences

3.21.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would continue current plant operations and not cease operations at its former SWL and Ash Impoundment 2 or close either of those facilities. Additionally, TVA would not construct and operate the proposed CCR Landfill at SHF, or haul CCR to an existing permitted landfill. Activities at SHF are performed in accordance with applicable standards or specific TVA guidance. SHF would continue to address and manage reduction or elimination of occupational hazards through implementation of safety practices, training, and control measures. No changes to current public and health and safety associated with SHF are anticipated under this alternative. Therefore, Alternative A would not have an impact on public health and safety.

3.21.2.2 Alternative B – Construction of Onsite Landfill and Closure of Existing Landfill and Ash Impoundment 2

3.21.2.2.1 Construction

Construction activities in support of the closure activities and the construction of the proposed CCR Landfill would be performed consistent with standards as established by OSHA and state requirements as well as BMPs and TVA safety plans and procedures. Construction activities include moving and backfilling CCR and borrow material, placement of geomembranes, and transportation of borrow material. Construction of the new landfill would require the use of earthmoving, compacting, and paving equipment as well as personal vehicles for workers and trucks for hauling materials.

The job site safety plans and BMPs would describe how job safety would be maintained. The BMPs and safety plans address the implementation of procedures to ensure that equipment guards, housekeeping, and personal protective equipment are in place; the establishment of programs and procedures for lockout, right-to-know, hearing conservation, equipment operations, excavations, grading, and other activities; the performance of employee safety orientations and regular safety inspections; and the development of a plan of action for the correction of any identified hazards. Construction debris and wastes would be managed in accordance with federal, state, and local requirements. All these measures would help ensure that job site safety risks are reduced.

Once closed, Ash Impoundment 2 and the former SWL would be appropriately maintained. Facility health and safety practices would address and manage the reduction or elimination of occupational and public health hazards through implementation of safety practices, training and control measures in accordance with applicable federal, state and local laws and regulations and all applicable permit requirements.

Activities occurring offsite include construction traffic and delivery of materials and supplies using local and regional roadways. Through its safety programs, TVA would foster a culture of safety-minded employees, including activities which are conducted offsite.

Construction activities in support of the facility closures and construction of new landfill would be performed consistent with standards established by OSHA. Operation of the landfill would adhere to TVA guidance and be consistent with standards established by OSHA. All facility wastes would be managed in accordance with applicable federal, state and local laws and regulations and all applicable permit requirements. No hazardous materials that might affect human safety are expected to be utilized under this alternative.

3.21.2.2.2 Operation

Operations at the proposed CCR Landfill would include the transport and handling of dry CCR. Dry CCR would be transported from SHF to the proposed CCR Landfill and would be distributed across the landfill surface. These activities, therefore, would be similar in nature to the construction activities associated with movement of CCR and other materials, earth-moving, and associated activities. Therefore, similar use of job safety plans, BMPs, and compliance with all federal, state, and local requirements would apply.

Overall, worker and public health and safety during construction and operation would be maintained and there would be no impact to public health and safety.

3.21.2.3 Alternative C – CCR Disposal at a Permitted Offsite Landfill and Closure of Existing Landfill and Ash Impoundment 2

The closure of the former SWL and Ash Impoundment 2 would be the same under Alternative C as described previously for Alternative B. In Alternative C, future CCR would be transported via truck to an offsite permitted landfill instead of an onsite landfill. Trucking is the most technically feasible mode of transport because it uses the existing roadway infrastructure that already serves the plant site and the receiving landfill. As discussed above with Alternative B, OSHA standards, TVA guidance, customary industrial safety standards, as well as the establishment of appropriate BMPs and site safety plans would maintain safety during construction activities.

The activities related to transport of borrow (Alternative B and Alternative C) and CCR removal and transport (Alternative C) require the movement of a large number of vehicles and operators. The duration of removal activities would extend for prolonged periods, essentially until SHF is decommissioned. As described in Subsections 3.1.2.3.2 and 3.19.2.3.2, the removal activities would result in greater environmental impacts associated with noise and emissions, degradation of roadway infrastructure (for truck movement, but also for rail movements when trucks have to be used to move CCR from the rail unloading facility to the landfill), increased risk of injuries and death, and increased potential for accidental releases. Therefore, the impacts to public health and safety due to increased truck movement would be greater than those under Alternative B, although would still be mitigated with appropriate training and other programs.

Transport of borrow or CCR by truck increases transportation risks. As number of truck movement miles increase, both for Alternatives B and C, the risk of traffic crashes, including personal injuries and fatalities, increases. A Kentucky Transportation Center September 2013 investigation of heavy truck crashes in Kentucky analyzed crash data for 2008-2012 (Green et al. 2016). The number of annual crashes involving trucks ranged from 7,442 to 9,092 while the number of fatal crashes involving trucks ranged from 70 to 105. For the five-year period studied, truck crashes represented 6.4 percent of all crashes, 5.5 percent of injury crashes, and 12.2 percent of fatal crashes. The statewide crash rate per 100 million vehicle miles (MVM) ranged from 163 to 226. On rural roadways that are characteristic of the roads serving TVA generating stations, statewide crash rates ranged from 183 to 217 per 100 MVM on two-lane roadways. Therefore, there is the potential for increased crash rates on roadways being used by heavy trucks to haul either borrow or CCR (TVA 2016b).

The facility closures and transportation of CCR activities would adhere to TVA safety guidance and be consistent with public health and safety standards established by OSHA as discussed in Alternative B. Therefore, with mitigation such as training programs and traffic studies, under Alternative C, worker and public health and safety during construction and operation would be maintained and there would be no significant impact to public health and safety. However, due to the increased truck miles, risk of crash or accident and deterioration of road quality could be greater under Alternative C than under Alternative B and would therefore constitute a minor impact the public health and safety.

3.22 Unavoidable Adverse Environmental Impacts

Unavoidable adverse impacts are the effects of the proposed actions on natural and human resources that would remain after mitigation measures or BMPs have been applied. Mitigation measures and BMPS are typically implemented to reduce a potential impact to a level that would be below the threshold of significance as defined by the CEQ and the courts. Impacts associated with the management of CCR from SHF have the potential to cause unavoidable adverse effects to several environmental resources.

The impacts from the Ash Impoundment 2 and former SWL closure would primarily be related to construction activities. Activities associated with the use of construction equipment may result in varying amounts of dust, air emissions, and noise impacts to the immediate vicinity. Emissions from onsite construction activities and equipment are minimized through implementation of BMPs, including proper maintenance of construction equipment and vehicles and wet suppression to control fugitive dust emissions. During construction, BMPs to minimize surface water runoff will be implemented but there could still be some uncontrolled runoff that could affect nearby outfalls and water bodies. Additionally, an increase in the construction workforce and some construction-related equipment could increase traffic on public roads. This additional construction-related traffic would also increase noise and fugitive dust in areas proximate to these roads. Emissions from transportation of CCR are minimized through implementation of BMPs including proper maintenance of equipment and vehicles and wet suppression to control fugitive dust.

Alternative B includes the construction of the proposed CCR Landfill on up to approximately 205 acres of mostly undeveloped former agricultural land, resulting in a permanent change in land use and a reduction in prime farmland and farmland of statewide importance in the area. This constitutes an unavoidable adverse impact. Clearing and grading of the site would result in long-term impacts to species composition and wildlife habitat. Potential bat habitat and wetlands on the site would be impacted by the clearing and grading activities. These would be unavoidable adverse impacts. The impacts associated with clearing of potential bat habitat and wetlands would be mitigated through consultation with the USFWS and USACE respectively. Impacts of clearing of other habitats on the site would be minor relative to the abundance of similar cover types within the vicinity. Impacts would be similar under Alternative C as the same site would be used for borrow material, resulting in similar changes to farmland, wildlife habitat, potential bat habitat, and wetlands. These would again be unavoidable adverse impacts under Alternative C.

3.23 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 impacts associated with the ongoing disposal of CCR at SHF over the next 20 years, including construction of the proposed CCR landfill. These activities are considered short-term uses for purposes of this section. The long-term is considered to be final closure of the CCR impoundments which would be initiated when operations at the Ash Impoundment 2 and the former SWL have ceased and the proposed CCR Landfill is closed CCR Landfill. Section 3.23 of the PEIS evaluated the relationship of short-term uses to long-term productivity for the closure of ash impoundments in general (TVA 2016b). 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 at SHF under the current proposed actions.

Closure of Ash Impoundment 2 and the former SWL would have a negative effect on a limited amount of short-term uses of the environment such as air, noise, and transportation resources. Access to Ash Impoundment 2 and the former SWL would be restricted during closure activities. In addition, closure activities such as site preparation and noise may displace some wildlife during the construction period. Most environmental impacts during closure activities would be relatively short term and would be addressed by programmatic BMPs and mitigation measures.

Unavoidable short-term impacts to water quality from runoff at the closure site could impact nearby outfalls and water bodies at the new landfill site during initial construction. BMPs to minimize runoff would be implemented.

The closure of Ash Impoundment 2 and the former SWL and construction of the proposed CCR Landfill would have a favorable short-term impact to the local economy through the creation of construction and support jobs and revenue.

Long-term effects of the closure activities would include the permanent loss of waterfowl and wading bird habitat and a permanent loss of aquatic habitat at Ash Impoundment 2. However, other higher quality waterfowl, wading bird, and aquatic habitat is located elsewhere in the vicinity of SHF.

Ash impoundments that are closed-in-place have safety and security requirements as well as post closure monitoring which could limit other future use of these lands. However, Ash Impoundment 2 is located in an area presently dedicated for industrial uses which already limit future use of the site.

In the near future, disposal of CCRs at all TVA coal-fired power plants will utilize a dry system. Ash impoundment closure at SHF would have a beneficial effect on long-term groundwater quality through the reduction or elimination of potential discharges of CCR constituents to groundwater that could occur as a result of continued use of the ash impoundment.

Short term and long term relationships would differ with respect to a new or existing CCR landfill under Alternatives B and C. Under Alternative B, short-term uses of the environment generally are those associated with construction, including labor and construction materials. For this project, construction activities are associated with the closure of Ash Impoundment 2 and the former SWL and the initial development of the proposed CCR Landfill at SHF, which would involve:

- Clearing and grading of the land to make way for the landfill.
- Transporting borrow material from the landfill site to Ash Impoundment 2 (if closure in place is selected).
- Placing the landfill composite liner system.

The acreage disturbed during the initial clearing for the proposed landfill site will have a negative effect on a limited amount of short-term uses of the environment such as air, noise, soil and visual resources. Unavoidable permanent impacts to visual resources along Gipson Road would occur. However, these would be minimized by mitigation measures which could consist of vegetative screening.

Additionally, these construction activities may displace some wildlife, aquatic resources, and alter existing vegetation. Since the proposed actions would occur within an area previously subject to human disturbance and the surrounding vicinity includes similar vegetation and habitat types, the short-term disturbance due to construction and operations is not expected to significantly alter long-term productivity of wildlife or other natural resources.

The day-to-day operation of SHF, the daily disposal of CCR, and the daily operation of the landfill at SHF are also considered to be short-term uses of the environment. Construction and operation of the landfill would have a favorable short-term impact to the local economy through the creation of construction and support jobs and revenue.

Long-term effects would include the permanent conversation of prime farmland into a CCR Landfill, the loss of terrestrial wildlife habitat within the landfill construction area. However, prime farmland is found throughout the region and other high quality forested habitat for displaced wildlife is located elsewhere in the vicinity of the project area. In addition, the formation and growth of the landfill over time will gradually alter the view around the landfill. Once the landfill ceases operation, there would also be limitations on future use of this land. However, as the proposed landfill is located on property developed for industrial use, any future land use would be limited to those uses that are compatible with industrial uses.

The development of the landfill at SHF would have a favorable long-term impact on the operations at SHF in that the proposed CCR Landfill offers TVA extended disposal capacity. The proposed landfill will also be developed to meet the requirements of the CCR rule and state requirements.

Under Alternative C, short term uses would consist of the closure of Ash Impoundment 2 and the transportation of CCR to an offsite landfill. The short term and long term uses at the Ash Impoundment 2 and Special Waste Landfill site would be similar under both alternatives. Under

Alternative C, the proposed CCR Landfill would not be constructed onsite, therefore, short term and long uses would be different. Short term uses would be associated with the necessity to transport CCR generated at SHF offsite and with the use of the Shawnee East Site for borrow material for the closure activities. Following completion of the closure activities, the Shawnee East Site would be revegetated once borrow material was no longer required. Therefore, there would be no changes to long term use from current conditions at the proposed landfill site. The use of the Freedom Waste Landfill would impact its capacity and, therefore, have an impact on the users of the landfill. However, there are other landfills within the region that may be utilized for disposal of waste materials.

3.24 Irreversible and Irretrievable Commitments of Resources

A resource commitment is considered irreversible when impacts from its use would limit future use options and the change cannot be reversed, reclaimed, or repaired. Irreversible commitments generally occur to nonrenewable resources such as minerals or cultural resources and to those resources that are renewable only over long time spans, such as soil productivity. A resource commitment is considered irretrievable when the use or consumption of the resource is neither renewable nor recoverable for use by future generations until reclamation is successfully applied. Irretrievable commitments generally apply to the loss of production, harvest, or natural resources and are not necessarily irreversible.

With respect to ash impoundment closure, resources that construction activities would require, including labor, fossil fuels, and construction materials, would be committed for the life of the project. Nonrenewable fossil fuels would be irretrievably lost through the use of gasoline and diesel-powered equipment during construction. In addition, construction materials (such as liners) would be consumed. However, it is unlikely that their limited use in these projects would adversely affect the future availability of these resources. (TVA 2016b)

The transfer of borrow material from the borrow site (whether from on- or offsite) to the ash impoundment could be both an irreversible and irretrievable commitment of resources. The loss of soil (which requires a very long time to generate) would constitute an irreversible and irretrievable resource commitment; however, revegetating the borrow site and ash impoundment would return both sites to productive status. Thus, the loss of vegetation until the areas are successfully revegetated would be an irretrievable commitment, but not irreversible. The loss of wetlands and bat habitat areas would also be irretrievable, though not irreversible because TVA would mitigate this loss in consultation with the USFWS and USACE. The loss of farmland, including approximately 198 acres of prime farmland would constitute an irreversible and irretrievable commitment. This land would no longer be available for the conceivable permanent future.

The land used for the ash impoundments that are closed-in-place would be irreversibly committed as the CCR material would remain in place for the foreseeable future representing a permanent commitment of the land and precluding future use of the land. However, as the Ash Impoundment 2 site would be vegetated, it would support some natural resources (therefore not irretrievable).

With respect to the construction of the proposed CCR Landfill at SHF (Alternative B), the land used for the proposed landfill would be irreversibly committed because the land would be permanently converted from an undeveloped use to a landfill that will remain for the life of the landfill. The materials used for the construction of the proposed landfill would be committed for the life of the landfill. All building materials associated with the construction of the landfill would be irrevocably committed.

Nonrenewable fossil fuels would be irretrievably lost through the use of gasoline and diesel-powered equipment during construction and transport of CCR to the landfill. In addition, construction materials (such as liners) would be consumed. However, their limited use in this project would not adversely affect the future availability of these resources.

Under Alternative C, the Freedom Waste Landfill is an existing landfill, and there would be no changes to the committed materials and resources associated with construction. However, nonrenewable fossil fuels would be irretrievably lost through the use of fuel by trucks used to transport CCR to this landfill. Due to the higher number of trucks needed and the greater number of miles travelled, this impact would be greater than that described for Alternative B, but would still be minor relative to existing supplies.

Any use of offsite borrow material during landfill operations (either at the proposed landfill or at the Freedom Waste Landfill) would be both an irreversible and irretrievable commitment of resources. However, given the limited use of this resource required for this action, the impact would not affect the future availability of the resource.

3.25 Cumulative Effects

The CEQ regulations implementing the procedural provisions of the NEPA of 1969, as amended, define cumulative impact as: "…the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR § 1508.7). A cumulative impact analysis must consider the potential impact on the environment that may result from the incremental impact of the project when added to other past, present, and reasonably foreseeable future actions. Baseline conditions reflect the impacts of past and present actions. The impact analyses summarized in preceding sections are based on baseline conditions, which reflect the cumulative effects of past and present actions in the vicinity.

This section is based on the resources of potential concern and the geographic area in which potential adverse effects from site-specific activities have the potential to alter (degrade) the quality of the regional environmental resource. The appropriate geographic area of analysis for SHF is therefore the immediate project area and vicinity (2-mile radius) surrounding SHF and the potential associated haul routes. For air quality, the geographic area is a 20-mile radius around SHF. This analysis addresses those resource areas potentially adversely affected by project activities under Alternatives B and C, the action alternatives, at the site. Resources that are not affected or that have an overall beneficial impact as a result of the proposed actions are not considered for cumulative effects. Accordingly, climate change, land use, floodplains, aquatic ecology, wetlands, socioeconomics and environmental justice, and safety resources are not included in this analysis as these resources are either not adversely affected or the effects are considered to be minimal or beneficial. Primary resource categories specifically considered in this cumulative effects assessment include air quality, prime farmlands, geology, groundwater, surface water, vegetation, wildlife, threatened and endangered species, natural areas, transportation, visual resources, cultural and historic resources, noise, and solid waste and hazardous waste and materials.

3.25.1 Identification of "Other Actions"

Past, present, and reasonably foreseeable future actions that are appropriate for consideration in this cumulative analysis are listed in Table 3.25-1. These actions were identified within the geographic area of analysis as having the potential to, in aggregate, result in larger and potentially significant adverse impacts to the resources of concern.

Actions that are listed as having a timing that is "past" or "present" inherently have environmental impacts that are integrated into the base condition for each of the resources analyzed in this chapter. However, these actions are included in this discussion to provide for a more complete description of their characteristics. Actions that are not reasonably foreseeable are those that are based on mere speculation or conjecture, or those that have only been discussed on a conceptual basis.

Table 3.25-1. Summary of Other Past, Present or Reasonably Foreseeable Future Actions in the Vicinity of the Proposed Project

Location	Action	Description	Timing and Reasonable Foreseeability
SHF	Dewatering Facility	Installation of dewatering facility to create dry CCR product	Reasonably Foreseeable Future
SHF	Access Road	Improving an existing access road from the powerhouse area to Anderson Road	Reasonably Foreseeable Future
West Paducah	Ohio River Mega Park	Industrial development adjacent to the railroad bridge to Metropolis	Reasonably Foreseeable Future – land owned by the Paducah Economic Development Commission
West Paducah	Road construction	New four lane connector road from Paducah to the Ohio River Mega Park	Reasonably Foreseeable Future – design phase authorized
West of Paducah	PGDP Decommissioning	Clean up, decontamination, and decommissioning of plant	Ongoing
Paducah	Floodwall project	Rehabilitation and upgrade of flood protection system	Ongoing
West of Paducah	Four Rivers Terminal	Barge loading facility adjacent to the railroad bridge to Metropolis	Operational as of 2015
Paducah	Riverfront redevelopment	Riverfront redevelopment	Phase I underway
West of	US 60	Widening of US 60 from Bethel	Reasonably Foreseeable

Location	Action	Description	Timing and Reasonable Foreseeability
Paducah		Church Road to HY-1154	Future – design phase authorized
West of Paducah	I-24 bridge	Scour mitigation	Construction phase
South of Paducah	US 62	Widening from KY 998 to Information Age Park	Reasonably Foreseeable Future – design phase authorized
West Paducah	I-24	Construct of new interchange at KY 998	Construction phase
Paducah	I-24 and US 60	Construct crossover interchange	Reasonably Foreseeable Future – design phase authorized

3.25.1.1 SHF Dewatering Facility

TVA recently evaluated the option of installing a dewatering facility at the SHF plant to allow for dry storage (Table 3.25-1). TVA will construct a bottom ash mechanical dewatering facility at SHF to create dry products for disposal in the former SWL. The bottom ash dewatering equipment would be located northeast of the powerhouse. A new drainage line running from the dewatering facility to the existing municipal infrastructure would be constructed, allowing a tie-in for sewage and wastewater from the new facility to SHF's existing system. Water generated from the dewatering process would return to the new sluice trench and be discharged through a permitted outfall or would be recirculated back into the system. Approximately 100-125 full and part-time jobs would be gained during construction with up to four full-time employees required to operate the facility (TVA 2016d).

3.25.1.2 SHF Access Road

TVA plans to improve an existing internal access road from just southeast of the power house to Anderson Road along the existing railroad tracks. This gravel road will be constructed entirely on existing TVA property. The road improvement was evaluated in a Categorical Exclusion.

3.25.1.3 Ohio River Mega Park

The Paducah Economic Development Commission is planning the development of at least 150 acres as an industrial park approximately 1.25 miles southeast of the proposed CCR landfill site. The Ohio River Triple Rail Megasite has three railroads, river access, a barge dock facility and all utilities. There are an additional 962 acres available on land to the northwest and southeast. There are two additional business parks located closer to Paducah which are already under development (Paducah Economic Development 2016).

3.25.1.4 West Paducah Road Construction

Due to the planned industrial development, Paducah and the Kentucky Transportation Cabinet are planning the construction of a new four lane road from Paducah to the Megasite (Kentucky Transportation Cabinet 2014). The Kentucky Transportation Cabinet completed a study in 2014 analyzing the benefits and feasibility of constructing a connector from I-24 to the industrial Ohio

River Megapark located approximately 1.25 miles southeast of SHF. Within this study, State Highway 358 is classified as a collector road. To the west of the intersection with State Highway 305, SH 358 is a two lane road with 10 foot wide lanes. The truck weight class of most of the roads in the connector study area was 44,000 pounds. SH 358 is designated for 80,000 pounds. I-24 is the only designated truck road in the area. Although the study area does not encompass SHF, generally all the roads in the area analyzed were operating at LOS A (free-flow conditions, high freedom to maneuver, and little or no delay). The study included future west extensions which could eventually connect to SHF (Kentucky Transportation Cabinet 2014). This connector has been funded and is in the design phase (Kentucky Transportation Cabinet 2016).

3.25.1.5 PGDP Decommissioning

The DOE is in the process of cleaning, decontaminating and decommissioning the former PGDP. The plant is currently designated a Superfund Site due to soil and groundwater contamination related to prior uranium enrichment activities (Lata Environmental Services of Kentucky 2014). The DOE has been remediating the site since 1990, having spent $1.9 billion to date. Remedial activities will continue indefinitely, including the demolition of the now unused facilities. (Energy.gov 2016) TVA has identified the reduced impact of the plume which is receding from the pump and treat remedial activities at DOE, due to the reduction in wells which contain the plume contaminants.

3.25.1.6 Paducah Floodwall

After several years of negotiations with the USACE and the federal government, the City of Paducah has been rehabilitating and updating the Paducah floodwall (flood protection system located near downtown Paducah) since 2005. Activities identified by the USACE in their 2000 shoreline study included the restoration of corrugated metal pipes, the replacement of existing motor control systems, the rebuilding/replacing of existing pump motors and pumps and the verification of the structural integrity of the levee and floodwall. The restoration of many of the metal pipes is complete. Currently, the design work for four pump stations is complete, two of these pump stations are close to failure, and a post authorization change request is in review due to estimation errors (City of Paducah 2016).

3.25.1.7 Four Rivers Terminal

SCH Services LLC, opened the Four Rivers Terminal in 2015. The facility is located immediately east of the train bridge to Metropolis, Illinois. The facility has an annual throughput capacity of over 10 million tons of coal. Future development plans include a stockpiling capacity as coal is currently directly loaded from rail to barge. American Electric Power is a subsidiary of SCH Services and operates the Cook Coal Terminal across the Ohio River in Metropolis (Coal Age 2015).

3.25.1.8 Paducah Riverfront Redevelopment

The original Paducah Riverfront Redevelopment Plan was adopted by the Paducah Board of Commissioners in 2007 (City of Paducah 2017). The Master plan states that the redevelopment “will provide a visually stunning riverfront incorporating public amenities, recreational facilities and public spaces that will link the City's downtown to the River". Proposed improvements included a terraced riverbank integrating overlooks, fountains, recreational trails, landscaping, reforming/renovating public infrastructure adjacent to the Executive Inn, and a new six-lane boat launch ramp located further downstream. These improvements would complement the redeveloped Public Steamboat Landing and Access Facility which was previously funded (City of Paducah 2007). Phase I-A was completed in 2013 and involved the expansion of Schultz Park by adding approximately 230,000 cubic yards of fill material into the Ohio River and the installation of 12, 36-inch steel pilings to support the gangway. Additionally, in 2013, the construction of a new boat launch facility with an 85-space parking/trailering lot at 6th and Burnett just downstream of the Paducah Expo Center was completed. The Ohio River Boat Launch includes a five- to six-lane boat ramp with an 8 by 80 foot gangway/courtesy dock. The project also included the construction of a paved boat launch access road. In 2015, Phase I-B was initiated to complete the surface of the park. Phase I-B also includes a gangway which will lead to a 20-foot wide, 400-foot long transient dock that will be capable of being extended to 1200 feet in length (City of Paducah 2017). The completion of the redevelopment is predicted to be in the spring of 2017 (Inman 2016).

3.25.1.9 Local Transportation Projects

There are five moderately sized transportation projects in the SHF vicinity which could contribute to cumulative impacts. These projects include the widening of US 60 from Bethel Church Road to Highway-1154, the I-24 scour mitigation (a joint project with the Illinois Department of Transportation), the widening of US 62 from KY 998 to Information Age Park, The construction of a new interchange at the junction of I-24 and SH 998, and the construction of a crossover interchange at the junction of I-24 and US 60. These projects are in various stages of completion, ranging from Right of Way acquisitions and utility adjustments to design to active construction (KTC 2017).

3.25.2 Analysis of Cumulative Effects

To address cumulative impacts, the existing affected environment geographically surrounding Alternatives B and C was considered in conjunction with the environmental impacts presented in previously Chapter 3. These combined impacts are defined by the CEQ as "cumulative" in 40 CFR 1508.7 and may include individually minor but collectively significant actions taking place over a period of time. The potential for cumulative effects to each of the identified environmental resources of concern are analyzed below for the preferred alternative.

3.25.2.1 Air Quality

In conjunction with the proposed actions at the SHF site, all of the other projects listed in Table 3.25-1 could contribute to cumulative impacts to air quality. These construction projects would all contribute to minor, temporary fugitive dust emissions during active construction. The dewatering facility and access road on the SHF property would contribute to minor, long-term emissions impacts to air quality as a result of ongoing operations activities which result in fugitive dust and vehicle emissions.

Activities at PGDP would contribute to operational air emissions and could result in minor adverse cumulative impacts to air quality in conjunction with the operational activities at SHF. PGDP air emissions are controlled under three authorities, the DUF_6 Conversion Facility Major Air Permit, the FFS Title V Air Permit, and CERCLA. As a Title V Permit holder, PGDP has the potential to emit more than 100 tons of regulated air pollutants, or 10 tons of a single Hazardous Air Pollutant or 25 tons of combined Hazardous Air Pollutants, and would be considered a major source. There are also temporary and intermittent sources at PGDP including emergency generators and remedial action equipment such as the groundwater plume extraction pumps. For calendar year 2015, PGDP did not receive any notices of violation (DOE 2016). The cumulative contribution of air quality impacts from the PGDP would, therefore, be expected to be temporary and intermittent.

Under Alternative B, the short- and long-term emissions from the reasonable and foreseeable projects in the vicinity in conjunction with the minor short- and long-term emissions from the proposed actions at SHF (closure of the former SWL and Ash Impoundment 2 and construction and operation of the proposed CCR Landfill) would contribute to minor, localized, cumulative impacts to air quality. These impacts would result primarily from vehicle emissions and mobilization of fugitive dust and would be minimized by adherence to permit requirements and use of BMPs. Due to the proximity of the PGDP activities, its major source designation and the length of time that these activities will occur in conjunction with the operation of the proposed CCR landfill, cumulative impacts to air quality may occur in the vicinity of SHF. However, as both entities are regulated under the Clean Air Act, these impacts would be considered minor as they would be required to meet regulations.

Under Alternative C, the transportation of dry CCR produced at SHF to an existing offsite landfill would occur throughout the operational phase (up to 20 years). This would result in slightly larger, though still minor, localized impacts to air quality than under Alternative B. Therefore, the proposed actions at SHF would contribute slightly more to localized cumulative air quality impacts. However, these impacts would still be minor as exceedances of applicable ambient air quality standards would not be anticipated. The cumulative impacts with respect to the remedial activities at PGDP would be smaller as the proposed CCR landfill operations would not be adjacent.

Additionally, under Alternative C, the transport of dry CCR from SHF to an offsite landfill could contribute to minor cumulative impacts to air quality in the larger, regional area. For example, if a CCR truck is traveling along a road that is under construction, and if congestion occurs as a result of the construction activities, the truck would emit more exhaust and fugitive particles in that location which could contribute to air quality impacts associated with the construction activities. The estimated 190 to 350 daily truck trips would also presumably all be travelling the same route, further adding to air quality impacts. However, the impacts would be highly localized in the immediate vicinity of the roadways/transportation projects, would be dispersed over the 20 mile radius, and would, therefore result in minor cumulative impacts.

3.25.2.2 Prime Farmlands

Under both Alternatives B and C there would be minor impacts to prime farmlands from the removal of soils at the Shawnee East Site for the construction of the proposed CCR Landfill and/or for borrow material. Either alternative would result in the removal of approximately 198 acres of prime farmland and farmland of statewide importance. The projects identified in Table 3.25-1 could also potentially impact prime farmland soils if such soils occur within the project areas and are previously undisturbed.

The SHF Dewatering Facility, SHF access road, PGDP decommissioning, Paducah floodwall project, Four Rivers Terminal, US 60 widening, I-24 bridge scour mitigation and US 62 widening projects would not be expected to result in significant cumulative impacts to prime farmlands as these projects occur in already disturbed areas or have limited areas of disturbance. The remaining projects, the Ohio River Mega Park, West Paducah four lane connector, Riverfront Redevelopment, I-24 interchange, and I-24/US 60 interchange projects have a greater potential to contribute to cumulative impacts to prime farmlands given the larger areas of disturbance. However, based on the acreage of available tillable land in McCracken County and the 5.24 million acres of prime farmland in Kentucky, the overall cumulative impacts to prime farmland would be minor.

3.25.2.3 Geology

Under Alternatives B and C, closure and capping of the former SWL and SHF Ash Impoundment 2 would decrease infiltration and the potential transport of CCR constituents into the unconsolidated clay, sand, silt, and gravel of the Mississippi Embayment; thus providing a localized, beneficial impact to the geology. Construction and operation of the new CCR landfill at the Shawnee East Site under Alternative B would impact the local geology. Impacts under Alternative C would be somewhat less than impacts under Alternative B because, although some soil would be excavated as borrow material for the closure of the former SWL and the SHF Ash Impoundment 2, the new CCR Landfill at the Shawnee East Site would not be constructed.

In addition to impacts from Alternatives B and C, soil disturbances from the projects identified in Table 3.25-1 may potentially impact geology in the area; thus potentially contributing to cumulative impacts to the geology. However, soil disturbances during construction of the projects in Table 3.25-1, would employ BMPs and utilize soil control measures to prevent soil erosion and runoff. Overall, the excavation and removal of some soils in conjunction with the projects listed in Table 3.25-1 as well as Alternatives B and C would contribute to minor adverse cumulative impacts to soils.

None of the projects listed in Table 3.25-1 or Alternatives B and C is likely to have a significant impact on the underlying geology in the area.

3.25.2.4 Groundwater

Closure and capping of the former SWL and SHF Ash Impoundment 2 under Alternatives B and C would decrease infiltration through the loess and alluvium into the UCD below. At SHF and at the Shawnee East Site, groundwater flows vertically through the alluvium UCD to the RGA, where gravels and sands provide the principle aquifer in the site region. As discussed in 3.6.1.2, the RGA is a semi-confined aquifer above the relatively low-permeability of the McNairy formation, which acts as an aquitard in the region.

Although BMPs would minimize soil disturbances and surface water runoff from the projects listed in Table 3.25-1, these disturbances could contribute to the cumulative impact to the groundwater.

The closure, including capping, of Ash Impoundment 2 and the former SWL (under both Alternatives B and C) would contribute to beneficial cumulative impacts to groundwater as a result of the reduction in hydraulic head driving ash constituents into groundwater. Cumulative groundwater impacts under Alternative C would be less than impacts under Alternative B because the new CCR Landfill at the Shawnee East Site would not be constructed.

3.25.2.5 Surface Water

Minor cumulative impacts associated with alterations of storm water flow and construction related storm water runoff, and leachate at the CCR Landfill are predicted under the Alternative B in conjunction with the PGDP project activities. Storm water from the proposed CCR Landfill project would discharge to an Unnamed Tributary of Little Bayou Creek. PGDP also has outfalls which discharge to Little Bayou Creek. Little Bayou Creek eventually flows to the Ohio River. SHF will monitor discharges and is required to develop BMPs to mitigate any potential negative impacts; this may include the possible rerouting of this waste stream to either the Process Water Basin(s) or to the Ohio River. The SHF project activities under Alternative C would have a smaller cumulative contribution to surface water impacts than Alternative B because the CCR Landfill would not be constructed, eliminating the potential for leachate to enter surface water at the Shawnee East Site.

Changes to localized storm water runoff patterns and construction related erosion are possible under both Alternatives B and C as well as during construction of the projects described in Table 3.25-1. Both SHF Alternatives as well as the projects in the vicinity would require the use of BMPs to prevent storm water and surface water impacts. In summary, with compliance with KDPES permits and the implementation of BMPs and other potential mitigation measures, the cumulative impacts to surface water would be minor.

3.25.2.6 Vegetation

Minor impacts due to changes in species composition during closure, construction and operation of the proposed CCR landfill or use of the area as borrow, are expected under Alternatives B and C. The projects described in Table 3.25-1 would also cause varying amounts of impacts to vegetation in the vicinity including removal of some vegetation and changes in species composition in other areas. However, due to the large amounts of similarly vegetated land in the area and because no rare species would be expected to be impacted by the combined projects, it is expected that the cumulative impacts would be minor.

3.25.2.7 Wildlife

The closure of Ash Impoundment 2 and the former SWL and the clearing of land at the Shawnee East Site would result in the disruption of wildlife habitat. The habitats present in areas that would be disturbed are not unusual, and the species affected are likely to occur throughout the project vicinity. The impacts to wildlife as a result of the implementation of either Alternative B or C would result in minor impacts. The construction of the projects described in Table 3.25-1 is also expected to disrupt wildlife habitat. However, due to the anticipated small size of these impacts and the large amount of similar habitat in the surrounding area, the combined project activities would result in minor cumulative impacts.

3.25.2.8 Threatened and Endangered Species

The only federally listed species that may be adversely affected under Alternatives B and C are the Indiana bat and northern long-eared bat. These bats could be affected by the clearing of wooded areas for the proposed CCR Landfill at the Shawnee East Site. Consultation with USFWS under Section 7 of the Endangered Species Act (ESA) is underway regarding the potential for impacts to these species. Potential direct and indirect impacts on these species would be avoided at SHF by scheduling the clearing of trees so that all potentially suitable roosting trees would be selectively removed between October 15 and March 31, the period when young are born and reared. Tree clearing is likely for at least some of the projects listed in Table 3.25-1, though specific details are not available for all of these projects. The projects that require tree removal, including Alternatives B or C, could all cumulatively contribute to adverse impacts to bat habitat in the area. Given the size of the projects (and presumably small amount of tree acreage that might be cleared) and the mitigation measures that would be applied for any federal projects including Alternatives B and C, it is assumed adverse cumulative impacts to bat habitat would be minor.

The species with state status that potentially could be affected by Alternatives B or C, in the area of disturbance for the proposed CCR Landfill include one plant that is state-listed as endangered (common silverbell) and five species of special concern: one plant (star tickseed), two birds (fish crow and Bell’s vireo), and two frogs (green tree frog and northern crawfish frog). Based on the analysis provided in Section 3.12, the potential direct and indirect effects on the populations of these state-status species in the vicinity of SHF would be minor. The projects listed in Table 3.25-1 could also potentially affect state-listed species or species of special concern if these species are present in those project areas. Given the low numbers of these species in the area, the potential for impacts is small. Projects with federal interest such as the Alternatives B and C, the dewatering facility, the PGDP, and at least some of the transportation projects, require species surveys and USFWS consultation be conducted to examine and minimize potential impacts. Therefore, overall the cumulative impacts to threatened and endangered species from the projects in Table 3.25-1 in conjunction with Alternatives B or C would be expected to be minor.

3.25.2.9 Natural Areas, Parks, and Recreation

Minor temporary impacts due to noise, dust, and traffic during construction and minor permanent impacts during operations at the Shawnee East Site are expected under Alternatives B and C. The impacts would be slightly larger under Alternative C as the trucks transporting dry CCR to the offsite landfill would travel past natural areas, whereas trucks transporting dry CCR under Alternative B would remain on TVA property. Under Alternative B, these impacts are minor and temporary in the construction phase and would be minor in the operations phase due to tree screening and BMPs, and should not contribute to cumulative impacts in conjunction with the other projects identified. Under Alternative C, possible cumulative impacts to natural areas are possible in conjunction with the other projects in the area. If truck transportation of CCR occurs on roads which are under construction and near natural areas, additional dust and noise would be present at some locations. As the route for transport could be adjusted to avoid local transportation projects, these impacts would be considered minor.

3.25.2.10 Transportation

Minor temporary impacts during construction activities due to workforce increase and materials delivery are expected under Alternative B. These impacts would be similar to those due to the other projects identified in the vicinity. However, due to the small workforce associated with the closure and landfill activities, they should not contribute to cumulative impacts, especially if the projects are separated in time. If needed, TVA would consult with the Kentucky Department of Transportation and county transportation officials to develop mitigation measures to counteract impacts. Under Alternative C, due to the large number of trucks transporting CCR to the offsite landfill, moderate cumulative impacts are possible. If the trucking route were to be on a road that was under construction, an additional 190 to 350 trucks on the road daily could contribute considerably to congestion. Additionally, heavy vehicle traffic on smaller feeder roads would be increased in some areas near transportation projects. Therefore, under Alternative C, moderate cumulative impacts to transportation are possible.

3.25.2.11 Visual Resources

Most of the projects identified in Table 3.25-1 could result in varying degrees of impacts to visual resources. However, the projects are all in existing transportation right-of-ways or in existing industrial areas. Therefore, visual impacts would be temporary and limited to the construction phase. No impacts to visual resources are expected during the Ash Impoundment 2 and former SWL closure activities other than those occurring onsite. The closure activities would be similar in appearance to operational activities and therefore, the closure would not contribute to cumulative visual resource impacts in the region.

Under Alternative B, the impacts associated with construction and operation of the new landfill would be minor due to the small number of residents that would be affected. It is also separated in space from the other projects in the area, and would not be visible beyond a limited radius due to the intervening vegetation and structures. Therefore, the new proposed CCR Landfill should not contribute to visual impacts in conjunction with the other local construction projects.

Impacts under Alternative C would be similar with respect to the removal of borrow material from the Shawnee East Site. However, visual impacts would be smaller than under Alternative B since the CCR Landfill would not be constructed. Additional visual impacts under Alternative C would be associated with the increased truck traffic on local roads. Neither action alternative should contribute significantly to cumulative impacts to visual resources.

3.25.2.12 Cultural and Historical Resources

With mitigation, minor impacts to cultural and historical resources are expected under the Alternatives B and C during construction of the proposed CCR Landfill. These impacts are related to two archeological sites adjacent to the Shawnee East Site. No impacts to historic architectural resources are expected. Mitigation to avoid disturbance of the archaeological sites is planned and consultation with the SHPO is ongoing. The projects in Table 3.25-1 may contribute to cumulative impacts to cultural resources, if cultural resources are present at or visible from these sites. For those projects with federal involvement, surveys and consultation with the SHPO would be conducted to minimize potential impacts. Since the two archeological sites adjacent to the Shawnee East Site are to be avoided during construction and operation of the proposed CCR Landfill (Alternative B), or excavation of the borrow area (Alternative C), neither alternative is expected to contribute to cumulative impacts to cultural and historic resources. The haul route from SHF to the Freedom Waste Landfill was evaluated for NRHP-listed sites to determine the potential for cumulative impacts to these resources as a result of increased construction traffic from the various projects. Two NRHP-listed properties, Kenmil Place and The Angles, are located within 0.25 mile of the potential transport route near the intersection of I-24 and State Highway 45 in Paducah. The cumulative contribution of CCR transport traffic from SHF and the other projects to the existing thousands of vehicles that traverse these roadways daily would be small. Therefore, transportation of dry CCR under Alternative C would not be expected to contribute to cumulative impacts to this cultural resource.

3.25.2.13 Noise

Under Alternative B, Closure activities and landfill construction at SHF would result in minor increases in noise during the closure activities, excavation of borrow materials, and construction and operation of the proposed CCR Landfill as a result of increased traffic and construction equipment. Due to the temporary nature of construction and the site's semi-rural location and distance to the nearest sensitive noise receptors, noise from construction is not expected to cause significant adverse impacts. Operation of the landfill facility would result in low noise levels that would potentially be detectable to local residents at times. The projects listed in Table 3.25-1 are far enough away from the proposed CCR Landfill site that cumulative increases in noise would not occur.

Under Alternative C, noise levels would be increased during closure activities and excavation of borrow material and slightly elevated during operations along the haul routes. Noise levels would be similar to those under Alternative B, but would impact a larger area. Depending on the haul routes and the construction schedules of the transportation projects in the vicinity, cumulative impacts to noise under Alternative C are possible. If haul routes and the transportation projects listed in Table 3.25-1 coincide, increases in congestion and the additional heavy vehicles on the road could contribute to cumulative impacts to noise in localized areas.

3.25.2.14 Solid Waste and Hazardous Waste and Hazardous Materials

Alternatives B and C would result in minor increases in solid waste during closure and construction activities. There would be no changes to the operational volume of waste generated by SHF. There would be minor increases associated with the volume of solid waste at the Shawnee East Site, associated with the construction of the proposed CCR Landfill (Alternatives B) and excavation of borrow material (Alternative C). The volume of waste associated with the projects identified in Table 3.25-1, is unknown, but is assumed to be relatively small. These projects, like the projects at SHF, would identify appropriate disposal facilities and handle all waste in accordance with federal, state, and local regulations. Therefore, cumulative impacts with respect to solid waste are expected to be minor.

CHAPTER 4 - LITERATURE CITED

AECOM. 2016. Final Report -Wetland Survey Shawnee Fossil Plant (SHF) McCracken County, KY. Prepared by AECOM, Franklin, TN November 2016.

Amec Foster Wheeler. 2016a. Phase I Archaeological Survey. TVA Shawnee Fossil Plant Proposed Borrow Area, McCracken County, Kentucky.

Amec Foster Wheeler. 2016b. Phase I Archaeological Survey. TVA Shawnee Fossil Plant Additional Property Acquisitions, McCracken County, Kentucky. Prepared for the Tennessee Valley Authority. November.

Boggs, J. M., and K. F. Lindquist. 2000. Shawnee Fossil Plant - Geologic and Hydrogeologic Characterization of the Special Waste Landfill. TVA Report WR2000-2-35-118.

Burns, R.M. and B.H. Honkala, tech. cords. 1990. *Carolina Silverbell, Halesia carolina* from Silvics of North America, vol. 2. U.S. Dept. of Agriculture, Forest Service, Washington, DC. https://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_2/halesia/carolina.htm.

City of Paducah. 2007. Riverfront Redevelopment Master Plan. Accessed on 4/11/17 at: http://www.paducahky.gov/~paducahky/sites/default/files/u3/FinalDraftMarch27-07.pdf.

City of Paducah. 2016. Ohio River Shoreline, Paducah Kentucky Reconstruction Project. Accessed on 10/26/16 at: http://www.paducahky.gov/sites/default/files/2016-03-15-Floodwall-Presentation-web.pdf.

City of Paducah. 2017. Riverfront Master Plan. Accessed on 4/11/17 at: http://www.paducahky.gov/riverfront-master-plan.

Coal Age. 2015. Four Rivers Terminal Opens. Accessed on 10/26/16 at: http://www.coalage.com/news/latest/4369-four-rivers-terminal-opens.html#.WBD9vU2Qzct

Cobb, J.C. 2009. University of Kentucky, Kentucky Geological Survey. Four Rivers Basin: Cumberland, Tennessee, Ohio, Mississippi. http://kgs.uky.edu/kgsweb/olops/pub/kgs/mc194_12.pdf. Accessed December 2016.

Council on Environmental Quality (CEQ). 1997. “Environmental Justice, Guidance Under the National Environmental Policy Act,” Executive Office of the President, Washington, DC, December 10, 1997.

U.S. Department of Energy (DOE) 2014. Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2012 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, PAD-ENR-0136. January.

DOE. 2015. Paducah Gaseous Diffusion Plant Draft Environmental Assessment for Potential Land and Facilities Transfers, McCracken County, Kentucky.

DOE. 2016. Paducah Site Annual Site Environmental Report for Calendar Year 2015. Accessed on 4/11/17 at: https://energy.gov/sites/prod/files/2016/09/f33/2015-Paducah-ASER.pdf.

eBird Basic Dataset. 2013. Version: EBD_relMay-2013. Cornell Lab of Ornithology, Ithaca, New York. Retrieved from http://ebird.org/ebird/hotspot/L677384 (accessed March 2016).

U.S. Environmental Protection Agency (EPA). Clean Water Act, Section 404. 1972. https://www.epa.gov/cwa-404/clean-water-act-section-404. Accessed December 2016.

EPA. 1974. Protective Noise Levels. Accessed 12/13/2016 at http://pbadupws.nrc.gov/docs/ML1017/ML101790276.pdf

EPA. 2010. Climate Change Impacts in the Southeastern United States Draft Discussion Paper. Washington, D.C., U.S.A. Accessed 12/12/2016 at http://media.timesfreepress.com/docs/2010/07/ClimateChangeSoutheastern_US.pdf

EPA. 2014. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012 (April 2014), Report No: EPA 430-R-14-003. Accessed 12/12/2016 at https://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2016-Main-Text.pdf

EPA. 2015. Designated Sole Source Aquifers in EPA Region IV. Retrieved from http://www.epa.gov/safewater/sourcewater/pubs/reg4.pdf (accessed September 2015).

EPA. 2016a. Current Nonattainment Counties for All Criteria Pollutants, As of September 22, 2016. Accessed on 10/24/16 at: https://www3.epa.gov/airquality/greenbook/ancl.html#TN

EPA. 2016b EPA's Climate Change Indicators in the United States. Accessed 12/12/2016 at https://www.epa.gov/sites/production/files/2016-11/documents/climate-indicators-2016-fact-sheet.pdf

EPA. 2016c. (CCR Rule) Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residues From Electric Utilities; Extension of Compliance Deadlines for Certain Inactive Surface Impoundments; Response to Partial Vacatur. Available at: https://www.federalregister.gov/documents/2016/08/05/2016-18353/hazardous-and-solid-waste-management-system-disposal-of-coal-combustion-residuals-from-electric

EPA. 2017. Relationship Between the Resource Conservation and Recovery Act's Coal Combustion Residuals Rule and the Clean Water Act's National Pollutant Discharge Elimination System Permit Requirements. Available online at: https://www.epa.gov/coalash/relationship-between-resource-conservation-and-recovery-acts-coal-combustion-residuals-rule.

Electric Power Research Institute (EPRI). 2014. Ohio River Ecological Research Program (ORERP), 2012 Ohio River Monitoring Results, Technical Report, August 2014.

EPRI. 2016. Relative Impact Framework for Evaluating Coal Combustion Residual (CCR) Surface Impoundment Closure Options. Technical Report 3002007543. May 2016.

Encyclopedia of Life. 2017. Available from http://www.eol.org. Accessed 3 Mar 2017.

Federal Emergency Management Agency (FEMA). 2011. McCracken County, Kentucky and Incorporated Areas, Flood Insurance Study, November 2, 2011.

Energy.gov. 2016. Paducah Cleanup Progress. Accessed on 10/26/16 at: http://www.energy.gov/pppo/paducah-cleanup-progress

Federal Highway Administration. 2011. Highway Traffic Noise: Analysis and Abatement Guidance. December 2011 FHWA-HEP-10-025. Accessed 12/13/2016 at http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/revguidance.pdf

Freedom Waste Service. 2016. Mayfield. Available online: https://www.freedomwasteservice.com/ (Accessed 23 November 2016).

Geocomp. 2016. Demonstration Document for Seismic Factor of Safety and Liquefaction Factor of Safety for TVA Shawnee Fossil Plant, Ash Pond 2, West Paducah, KY. October.

Good Sam. 2016. Fern Lake Campground. Accessed on 10/25/16 at: http://www.goodsamclub.com/travel/campgroundsandrvparks/generalinfo.aspx?cgid=920000302&returnUrl=http%3A%2F%2Fwww.goodsamclub.com%2Fsearch-by-map%2F%23latitude%3D37.021370000000005%26longitude%3D-88.58667000000001%26zoom%3D11%26features%3D0%26list%3Dtrue

Google Earth. 2016. Earth imagery map of the Metropolis, Illinois/Paducah, Kentucky area. Accessed on 11/3016.

Green, E. R., K. R. Agent, J. G. Pigman, and Fields, M. A. 2013. Analysis of Traffic Crash Data in Kentucky (2003 – 2013). Kentucky Transportation Center, College of Engineering, University of Kentucky in cooperation with Kentucky Transportation Cabinet. Research Report KTC-4-7/KSP2-13-1F.

Green et al. 2016. Analysis of Traffic Crash Data in Kentucky (2008 – 2012). Kentucky Transportation Center. Accessed 12/5/2016 at http://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1318&context=ktc_researchreports

Harvey, M.J., J. S. Altenbach, and T. L. Best. 2011. *Bats of the United States and Canada*. The John Hopkins University Press, Baltimore, MD. 202pp.

Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K. 2015. Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing*, v. 81, no. 5, p. 345-354

Illinois Department of Natural Resources (IDNR). 2016a. Halesia. Accessed on 12/8/16 at: https://www.dnr.illinois.gov/INPC/Pages/Area9MassacHalesia.aspx

IDNR. 2016b. Sielbeck Forest State Natural Area. Accessed on 12/8/16 at: http://dnr.state.il.us/lands/landmgt/parks/r5/sielbeck.htm

IDNR. 2016c. Fort Massac State Park. Retrieved from http://www.dnr.illinois.gov/Parks/Pages/FortMassac.aspx (accessed March 2016).

IDNR. 2016d. Ohio River. Accessed on 10/25/16 at: http://www.ifishillinois.org/profiles/Ohio.php

Illinois Natural History Survey. 2016. *Lithobates areolatus* (Baird & Girard 1852) – Crawfish Frog. Retrieved from http://wwx.inhs.illinois.edu/collections/herps/data/ilspecies/ra_areolat/ (accessed March 2016).

Inman, Taylor. 2016. Paducah Riverfront Development Project Sets Sights on Completion for Spring 2017. Accessed on 4/11/17 at: http://wkms.org/post/paducah-riverfront-development-project-sets-sights-completion-spring-2017.

Intergovernmental Panel on Climate Change (IPPC). 2013. Climate Change 2013: The Physical Science Basis. Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Accessed 12/20/2016 at: http://www.ipcc.ch/report/ar5/wg1/.

Jenniges, A. J. and R. G. Plettner. 2008. “Least tern nesting at human created habitats in Central Nebraska.” *Waterbirds* 31:274-282.

Karpynec and Weaver. 2017. Management Summary, Phase I Architectural Survey for the Proposed TVA Shawnee Fossil Plant Dry Ash Landfill Project, McCracken County, Kentucky

Kellberg, J. M. 1951. Geology of the Shawnee Steam Plant Site. Tennessee Valley Authority.

Kentucky Administrative Regulations (KAR). 2016. Kentucky Administrative Regulations Chapter 63:010. Accessed 12/19/16 at http://www.lrc.ky.gov/kar/401/063/010.htm

Kentucky Assembly. 2008. KRS 224.50-760 Special wastes -- Exemptions from KRS 224.46-510 and 224.46-520 -- Permit -- Notice -- Hearing. Accessed on 1/25/17 at: http://www.lrc.ky.gov/Statutes/statute.aspx?id=10471

Kentucky Assembly. 2016. 401 KAR 46:110. Standards for the disposal of coal combustion residuals (CCR) in CCR units. Accessed on 1/25/17 at: http://www.lrc.state.ky.us/kar/401/046/110reg.htm

Kentucky Department for Environmental Protection (KDEP), 2001. Total Maximum Daily Load (TMDL) Development – Polychlorinated Biphenyls (PCBs) – For Little Bayou Creek (McCracken County, Kentucky). Division of Water. November.

KDEP. 2005. KPDES No. FY0004219. Frankfort, KY. Division of Water. September 1, 2005.

KDEP. 2013a. Division of Water. October 3, 2013. Final 2012 Integrated Report to Congress on the Condition of Water Resources in Kentucky. Volume II. 303(d) List of Surface Waters.

KDEP, 2013b. Final 2012 Integrated Report to Congress on the Condition of Water Resources in Kentucky, Volume II, 303(d) List of Surface Waters. Division of Water. October 3.

Kentucky Department for Environmental Protection (KDEP). Website updated September 22, 2014. Kentucky Legislature, Kentucky Administrative Regulations, Title 401. Available at: http://www.lrc.state.ky.us/kar/TITLE401.HTM and http://www.lrc.state.ky.us/kar/401/010/031.htm) (Accessed December 9, 2016).

Kentucky Department of Fish and Wildlife Resources (KDFWR). 2010. Action Plan to Respond to Climate Change in Kentucky: A Strategy of Resilience, 37 pp., Accessed 12/12/2016 at http://fw.ky.gov/WAP/Documents/Climate_Change_Chapter.pdf

KDFWR. 2013. Kentucky's Comprehensive Wildlife Conservation Strategy. February. http://fw.ky.gov/WAP/Pages/Default.aspx.

KDFWR. 2016a. West Kentucky Wildlife Management Area. Retrieved from http://fw.ky.gov/more/documents/west_kentucky_wma.pdf (Accessed March 2016).

KDFWR. 2016b. West KY Wildlife Management Area. Accessed on 10/25/16 at: https://app.fw.ky.gov/fisheries/waterbodydetail.aspx?wid=181

KDFWR. 2016c. Public Lands Hunting. Accessed on 10/25/16 at: http://fw.ky.gov/Hunt/Pages/Public-Land-Hunting.aspx

KDFWR. 2016d. Metropolis Lake. Assessed on 10/25/16 at: https://app.fw.ky.gov/fisheries/waterbodydetail.aspx?wid=182

Kentucky Revised Statutes (KRS). 2016. Chapter 38. Accessed 12/7/2016 at http://www.lrc.ky.gov/statutes/chapter.aspx?id=37194

Kentucky State Nature Preserves Commission (KSNPC). 2015. County Report of Endangered, Threatened, and Special Concern Plants, Animals, and Natural Communities of

Kentucky. December. Retrieved from http://naturepreserves.ky.gov/pubs/publications/ksnpc_countylisthabitat.pdf

KSNPC. 2016a. Standard occurrence report of endangered, threatened, and special concern species within 10 miles of SHF. April 28.

KSNPC. 2016b. Metropolis Lake State Nature Preserve. Accessed on 11/30/16 at: https://naturepreserves.ky.gov/naturepreserves/Pages/metrolake.aspx

Kentucky Transportation Cabinet (KYTC). 2014. Ohio River Megapark Connector Study. McCracken County. KYTC Item No. 1-8702.00

KYTC. 2015a. McCracken County Traffic Maps. Accessed on 12/29/16 at: http://transportation.ky.gov/Planning/Traffic%20Count%20Maps/mcra.pdf

KYTC. 2015b. Paducah Traffic Map. Accessed on 12/29/16 at: http://transportation.ky.gov/Planning/Traffic%20Count%20Maps/paducah.pdf

KYTC. 2015c. Graves County Traffic Map. Accessed on 12/29/16 at: http://transportation.ky.gov/Planning/Traffic%20Count%20Maps/grav.pdf

KYTC. 2017. Project Managers Toolbox. Accessed on 4/11/17 at: http://www.pmtoolbox.kytc.ky.gov/.

Kunkel *et al.*. 2013: Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 2. Climate of the Southeast U.S. NOAA Technical Report. Accessed 12/12/2016 at https://scenarios.globalchange.gov/sites/default/files/NOAA_NESDIS_Tech_Report_142-2-Climate_of_the_Southeast_U.S_0.pdf

Kurta, A, S. W. Murray, and D. H. Miller. 2002. Roost selection and movements across the summer landscape. In Kurta, A. and J. Kennedy, Eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International, Austin, Texas.

LATA Environmental Services of Kentucky. 2014. Site Management Plan, Paducah Gaseous Diffusion Plant , Paducah, Kentucky. Annual Revision—FY 2015. Date Issued—November 2014. Accessed on 10/16/15 at: http://energy.gov/sites/prod/files/2015/01/f19/20141113%20D1%20FY%202015%20SMP%20REG%20Pub%20Docs.pdf

Le Quéré *et al.*. 2013. Global Carbon Budget 2013, Earth Syst. Sci. Data 6: 689-760. doi: 10.5194/essd-6-235-2014. Accessed 12/12/2016 at http://www.geocarbon.net/images/phocadownload/lequere_et_al_2014_global%20carbon%20budget%202013.pdf

Mack, John J. 2001. Ohio Rapid Assessment Method for Wetlands, Manual for Using Version 5.0. Ohio EPA Technical Bulletin Wetland/2001-1-1. Ohio Environmental Protection Agency, Division of Surface Water, 401 Wetland Ecology Unit, Columbus, Ohio.

McCracken County Agriculture Development Council. 2008. Comprehensive Plan. Available at: http://www2.ca.uky.edu/anr/County%20Comprehensive%20Plans/2008%20Comp%20Plans/McCracken%20County%20Ag%20Dev%20Council%20Plan%2008.pdf.

McCracken County and Paducah Geographic Information System. 2016. Accessed on 12/1/16 at: http://map-gis.paducahky.gov/ZoningMapPub/index.html

Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds. 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program. Accessed 12/12/2016 at http://www.globalchange.gov/sites/globalchange/files/NCA3_Highlights_LowRes-small-FINAL_posting.pdf

Muncy, J. A. 2012. A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities, Revision 2.1.

National Geographic Society. 2002. A Field Guide to the Birds of North America. 4th ed. National Geographic Society Washington, D.C. 480pp.

National Register of Historic Places (NRHP). 2016. Illinois, Massac County. Accessed on 12/5/16 at: http://www.nationalregisterofhistoricplaces.com/il/massac/state.html

National Resource Conservation Agency (NRCS). 2016. Web Soil Survey. Accessed on 12/1/16 at: http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

NRCS. 2017. Farmland Protection Policy Act. Accessed on 4/6/17 at: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/?cid=nrcs143_008275

NatureServe. 2016. NatureServe Explorer: An Online Encyclopedia of Life, Web Service. Arlington, VA. U.S.A. 2016. Retrieved from http://services.natureserve.org (accessed October 2016).

NatureServe. 2017. NatureServe Explorer: An online encyclopedia of life (web application). Version 7.0. NatureServe, Arlington, VA. Available at http://services.natureserve.org (accessed February 2017).

NEPAssist. 2016. Online Environmental Mapper. Accessed on November 30, 2016 at: https://nepassisttool.epa.gov/nepassist/nepamap.aspx?wherestr=paducah%2C+kentucky.

Ohio River Valley Water Sanitation Commission. 2009. A biological study of the open water section of the Ohio River. Biological Programs 2009 Intensive Survey Results. Series 6 Report 4.

Ohio River Valley Water Sanitation Commission (ORSANCO). 2014. Accessed October 16, 2014. “River Facts/Conditions.” (See http://orsanco.org/river-factsconditions)

Paducah Economic Development Commission. 2016. Ohio River Triple Rail Megasite. Accessed on 10/26/16 at: http://epaducah.com/locate-here/sites-buildings/

Palmer-Ball Jr., B. L. 1996. The Kentucky Breeding Bird Atlas. The University of Kentucky Press. Lexington, Kentucky. 372 pp.

Pruitt, L. and L. TeWinkel, editors. 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 260 pgs. Retrieved from http://www.fws.gov/midwest/endangered/mammals/ inba/pdf/inba_fnldrftrecpln_apr07.pdf (accessed November 2016.

Spear, K. A., S.H. Schweitzer, R. Goodloe, and D. C. Harris. 2007. “Effects of management strategies on the reproductive Success of Least Terns on dredge spoil in Georgia.” *Southeastern Naturalist* 6(1): 27-34.

Stantec Consulting Services, Inc. 2016a. Closure Plan (Rev 1) Ash Pond 2 and Special Waste Landfill Final Closure Project, TVA Shawnee Fossil Plant, Paducah, McCracken County, Kentucky. Prepared for Tennessee Valley Authority. October 14.

Stantec. 2016b. TVA SHF, HELP Model Leachate and Storm Water Generation Estimates.

Stantec Consulting Services, Inc. 2016c. Project Planning Document (Rev. 1) New Landfill Siting Study TVA Project No. FP609511 Shawnee Fossil Plant, Paducah, McCracken County, Kentucky. Prepared for Tennessee Valley Authority. October 10.

Stantec. 2017. Geotechnical/Hydrogeologic Report. Shawnee Fossil Plant. CCR Proposed Landfill. Prepared for: Tennessee Valley Authority Prepared by: Stantec Consulting Services Inc. April 2017

Tennessee Valley Authority (TVA). 2005. NOxOUT Selective Non-catalytic Reduction Demonstration - Shawnee Fossil Plant – Unit 1 Final Environmental Assessment. Tennessee Valley Authority, Chattanooga, TN.

TVA. 2014. Final Environmental Assessment, *Final SHF Fossil Plant Units 1 and 4 EA*, Chapter 3,McCracken County, Kentucky, December 2014

TVA. 2016a. Shawnee Fossil Plant – SWL – Permit No. 073-00041 – Finds No. KY4-640-006-686/1 – May 2016 Groundwater and Surface Water Monitoring Reports for First Half 2016. July.

TVA. 2016b. Ash Impoundment Closure Final Environmental Impact Statement Part I Programmatic Review (PEIS) and Part II Site-Specific Review of 10 Ash Impoundments. Available online at: https://www.tva.gov/Environment/Environmental-Stewardship/Environmental-Reviews/Closure-of-Coal-Combustion-Residual-Impoundments. July.

TVA. 2016c. Bull Run Fossil Plant Landfill Final Environmental Impact Statement. Anderson County, Tennessee

TVA. 2016d. Shawnee Fossil Plant Bottom Ash Process Dewatering Facility: Final Environmental Assessment, McCracken County, Kentucky. September 2016.

TVA. 2016e. Regional Natural Heritage Database. Accessed November 2016.

TVA. 2017. TVA Technical Memorandum – Shawnee CCR EIS NEPA Surface Water, A.C. Williams, January 27, 2017.

Tuttle, M. D. 1976. Population ecology of the gray bat (*Myotis grisescens*): philopatry, timing, and patterns of movement, weight loss during migration, and seasonal adaptive strategies. Occasional Papers of the Museum of Natural History, University of Kansas.

United States Army Corps of Engineers (USACE). 1987. Wetlands Delineation Manual. Environmental Laboratory (EL) of the U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi.

USACE. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-20. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

USACE. 2014. Louisville District. “Olmstead Locks and Dam. Accessed October 16, 2014 at: http://www.lrl.usace.army.mil/Missions/CivilWorks/Navigation/LocksandDams/OlmstedLocksandDam.aspx).

USACE. 2017. Approved Jurisdictional Determination. Letter from Matt Dennis (USACE) to Randle DeHart (TVA). March 17.

U.S. Census Bureau. 2016a. DP05, ACS Demographic and Housing Estimates, 2010-2014 5-Year American Community Survey. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml (accessed 11/9/2016).

U.S. Census Bureau. 2016b. DP0-1, Profile of General Population and Housing Characteristics: 2010. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml (accessed 11/18/2016).

U.S. Census Bureau. 2016c. B25001, Housing Units. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t (accessed 12/21/2016).

U.S. Census Bureau. 2016d. B19013, Median Household Income in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t (accessed 12/21/2016).

U.S. Census Bureau. 2016e. S1701, Poverty Status of Individuals in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t (accessed 11/22/2016).

U.S. Census Bureau. 2016f. DP03, Selected Economic Characteristics, 2010-2014 American Community Survey 5-Year Estimates. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t (accessed 12/21/2016).

U.S. Department of Agriculture (USDA). 2015. Summary Report: 2012 National Resources Inventory, Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. http://www.nrcs.usda.gov/technical/nri/12summary

U.S. Department of Housing and Urban Development. 1985. The Noise Guidebook, HUD-953-CPD Washington, D.C., Superintendent of Documents, U.S. Government Printing Office.

U. S. Fish and Wildlife Service (USFWS). 2015a. 2015 Range-Wide Indiana Bat Summer Survey Guidelines. Available online: http://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/2015IndianaBatSummerSurveyGuidelines01April2015.pdf (accessed November 2015).

USFWS. 2015b. Northern Long-Eared Bat Fact Sheet. Bloomington, MN. Retrieved from http://www.fws.gov/Midwest/endangered/mammals/nleb/pdf/NLEBFactSheet01April2015.pdf (accessed March 2016).

USFWS. 2015c. Species profile for rabbitsfoot (*Quadrula cylindrica* ssp. *cylindrica*). Retrieved from http://ecos.fws.gov/tess_public/profile/speciesProfile;jsessionid=8EF0CEC98EE676B017B93F04B34D829E?spcode=F03X#crithab (accessed March 2016).

USFWS. 2016a. Information for Planning and Conservation (IPaC) Trust Resources Report for McCracken County, Kentucky. Retrieved from https://ecos.fws.gov/ipac/ (report generated December 1, 2016).

USFWS. 2016b. Revised Conservation Strategy for Forest Dwelling Bats in the Commonwealth of Kentucky. June. Available online: https://www.fws.gov/frankfort/pdf/20160601%20Revised%20FDBatConservStrategy.pdf (accessed March 2017).

USFWS. National Wetlands Inventory (NWI). 2016c. https://www.fws.gov/wetlands/Data/Mapper.html. Accessed December 2016.

United States Geological Service (USGS) 2009. New Madrid 1811 Earthquake. http://www.webcitation.org/mainframe.php

USGS. 2014. National Seismic Hazard Maps. Available at: https://earthquake.usgs.gov/hazards/hazmaps/conterminous/index.php#2014

USGS. 2017. Summary of 1811-1812 New Madrid Earthquakes Sequence. Earthquake Hazards Program. Available online at: https://earthquake.usgs.gov/earthquakes/events/1811-1812newmadrid/summary.php (Accessed April 2, 2017).

U.S. Water Resources Council. 1978. Floodplain Management Guidelines for Implementing E.O. 11988. 43 FR 6030, Second Reprinting.

Woods, A.J., Omernik, J.M., Martin, W.H., Pond, G.J., Andrews, W.M., Call, S.M, Comstock, J.A., and Taylor, D.D., 2002, Ecoregions of Kentucky (color poster with map, descriptive text, summary tables, and photographs): Reston, VA., U.S. Geological Survey (map scale 1:1,000,000).

CHAPTER 5 - LIST OF PREPARERS

5.1 NEPA Project Management

Name:	**Ashley Pilakowski (TVA)**
Education:	B.S., Environmental Management
Project Role:	TVA NEPA Project Manager, TVA NEPA Coordinator, NEPA Compliance
Experience:	6 years in environmental planning and policy and NEPA compliance

Name:	**Anita Masters (TVA)**
Education:	M.S., Biology/Fisheries; B.S., Wildlife Management
Project Role:	TVA NEPA Project Manager, TVA NEPA Coordinator, NEPA Compliance
Experience:	29 years in project management, NEPA and Endangered Species Act compliance and community/watershed biological assessments.

Name:	**James Cedric Adams (TVA)**
Education:	B.S., Chemical Engineering
Project Role:	TVA Senior Project Manager
Experience:	30 years in environmental and project management

Name:	**Shane Harris (TVA)**
Education:	B.S. Environmental Science
Project Role:	TVA Senior Program Manager
Experience:	17 years in waste handling and Management

Name:	**Roberta Hurley (AECOM)**
Education:	B.S. and M.S., Engineering
Project Role:	AECOM Project Manager, NEPA Compliance
Experience:	30 years of experience in NEPA document preparation

Name:	**Carol Butler Freeman (AECOM)**
Education:	M.S., Geological Sciences; BS, Geology
Project Role:	AECOM Deputy Project Manager, Project Coordinator, NEPA Compliance, and Cultural Resources
Experience:	9 years of experience in NEPA document preparation

5.2 Other Contributors

Tennessee Valley Authority

Name:	**Kevin Davenport**
Education:	B.S. Environmental Science
Project Role:	Project Environmental Support
Experience:	28 years in multi-media environmental compliance

Name:	**Elizabeth B. Hamrick**
Education:	M.S., Wildlife and B.S. Biology
Project Role:	Terrestrial Ecology (Animals), Terrestrial Threatened and Endangered Species
Experience:	17 years conducting field biology, 12 years technical writing, 8 years compliance with NEPA and ESA.

Name:	**Adam Dattilo**
Education:	M.S., Forestry
Project Role:	Vegetation, Threatened and Endangered Plants
Experience:	10 years botany, restoration ecology, threatened and endangered plant monitoring/surveys, invasive species control, as well as NEPA and ESA compliance

Name:	**Michaelyn S. Harle**
Education:	PhD. Anthropology
Project Role:	Archaeologist; Cultural and Historic
Experience:	13 years in Archaeology and Cultural Resources Management

Name:	**Ronda Hooper**
Education:	B.S. Civil Engineering
Project Role:	Ash and Groundwater Permitting and Compliance
Experience:	37 years in environmental compliance

Name:	**Robert Marker**
Education:	B.S., Outdoor Recreation Resources Management
Project Role:	Parks and Recreation
Experience:	40 years in outdoor recreation resources planning and management.

Name:	**Craig Phillips**
Education	M.S. and B.S., Wildlife and Fisheries Science
Project Role:	Aquatic Ecology and Threatened and Endangered Species
Experience:	7 years sampling and hydrologic determination for streams and wet-weather conveyances; 5 years in environmental reviews

Name: **Kim Pilarski-Hall**
Education: M.S., Geography, Minor Ecology
Project Role: Wetlands, Natural Areas
Experience: 20 years of expertise in wetland assessment, wetland monitoring, watershed assessment, wetland mitigation, restoration as well as NEPA and Clean Water Act compliance

Name **A. Chevales Williams**
Education: B.S. Environmental Engineering
Project Role: Surface Water
Experience: 12 years of experience in water quality monitoring and compliance; 11 years in NEPA planning and environmental services

Name: **Carrie Williamson, P.E., CFM**
Education: B.S. and M.S., Civil Engineering
Project Role: Floodplains
Experience: 4 years Floodplains, 3 years River Forecasting, 7 years compliance monitoring

AECOM

Name: **Anneliesa Barta**
Education: M.B.A. Finance
Project Role: Air Quality, Climate Change, Public Health and Safety
Experience: 10 years of experience in Environmental and Sustainability planning, 2 years of experience in NEPA document preparation

Name: **Ashley Bray**
Education: B.S. Marine Science
Project Role: Socioeconomics
Experience: 3 years of experience socioeconomic analysis and 7 years of experience in NEPA document preparation

Name: **Zoe Knesl**
Education: M.S. Marine Science
Project Role: Natural Areas, Parks, and Recreation Areas, Land Use, Prime Farmlands, Transportation, Visual Resources, Noise
Experience: 8 years of experience in NEPA document preparation

Name:	**James Orr**
Education:	B.S. and M.S., Biology
Project Role:	Vegetation, Wildlife, Aquatic Ecology, Wetlands, and Threatened and Endangered Species
Experience:	30 years of experience in NEPA document preparation

Name:	**Laura Owens**
Education:	B.S., Physics and Geology
Project Role:	Geology and Seismology, Groundwater, Solid Waste and Hazardous Materials
Experience:	4 years of experience in in NEPA document preparation; 15 years environmental services

Name:	**Michael Przybyla**
Education:	M.S., Planning
Project Role:	Visual Resources
Experience:	20 years of experience in environmental analysis, GIS, and the preparation of photographic renderings

Name:	**Daniel Wade**
Education:	B.S. Environmental and Soil Science, MS Biosystems Engineering Technology
Project Role:	Floodplains, Wetlands, GIS analysis
Experience:	2 years of experience in NEPA document preparation

CHAPTER 6 - ENVIRONMENTAL IMPACT STATEMENT RECIPIENTS

Federal Agencies
U.S. Army Corps of Engineers, Louisville District
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency, Region 4
U.S. Department of Interior

Federally Recognized Tribes
Absentee Shawnee Tribe of Oklahoma
Cherokee Nation
Eastern Band of Cherokee Indians
Eastern Shawnee Tribe of Oklahoma
Shawnee Tribe
United Keetoowah Band of Cherokee Indians in Oklahoma

State Agencies
Kentucky Department for Environmental Protection
Kentucky Department for Energy Development and Independence
Kentucky Department of Natural Resources
Kentucky Energy and Environment Cabinet
Kentucky Heritage Council
Kentucky Fish and Wildlife
Kentucky State Clearinghouse
Kentucky State Historic Preservation Officer
Land Between the Lakes
Natural Resources Conservation Service

This page intentionally left blank

Appendix A – Scoping Report

Appendix A – Scoping Report

Document Type:	EIS–Administrative Record
Index Field:	EIS Scoping Report
Project Name:	Shawnee CCR EIS
Project Number:	2016-13

Shawnee Fossil Plant (SHF) Coal Combustion Residual (CCR) Management Environmental Impact Statement

Public Scoping Report

Prepared by:
TENNESSEE VALLEY AUTHORITY
Knoxville, TN

February 2017

Ashley Pilakowski
NEPA Compliance
Tennessee Valley Authority
400 W. Summit Hill Drive
Knoxville, TN 37902
Phone: 865-632-2256
aapilakowski@tva.gov

This page intentionally left blank

Table of Contents

Appendices

Symbols, Acronyms, and Abbreviations

CCR	Coal Combustion Residuals
CCR Rule	U.S. Environmental Protection Agency's final Disposal of Coal Combustion Residuals from Electric Utilities rule
CFR	Code of Federal Regulations
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
ELG	Effluent Limitation Guidelines
EPA	U.S. Environmental Protection Agency
IPaC	U.S. Fish and Wildlife Service's Information for Planning and Conservation system
MCLs	EPA Maximum Contaminant Levels
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NOI	Notice of Intent
PEIS	Final Programmatic Environmental Impact Statement
RCRA	Resource Conservation and Recovery Act
SHF	Shawnee Fossil Plant
SHPO	State Historic Preservation Officer
TDS	total dissolved solids
TVA	Tennessee Valley Authority

Shawnee Fossil Plant (SHF) Coal Combustion Residuals (CCR) Management Environmental Impact Statement (EIS)

Public Scoping Report

January 2017

The Tennessee Valley Authority (TVA) has proposed closure of the existing coal combustion residuals (CCR) Ash Impoundment 2 impoundment and Special Waste Landfill, and construction and operation of a new onsite landfill to accommodate future dry CCR disposal at the Shawnee Fossil Plant located in Paducah, Kentucky. The proposal supports TVA's goal to eliminate all wet ash storage at its coal plants and will meet U.S. Environmental Protection Agency's (EPA) final Disposal of Coal Combustion Residuals from Electric Utilities rule (CCR Rule) and state permitting requirements. Therefore, TVA is initiating the preparation of an Environmental Impact Statement (EIS) pursuant to the National Environmental Policy Act (NEPA) to assess the environmental impacts of the proposed actions.

1.1 Background

Historically, TVA has managed its CCR in wet impoundments or dry landfills. In July 2009, the TVA Board of Directors passed a resolution for staff to review TVA practices for storing CCR at its generating facilities, including SHF, which resulted in a recommendation to convert the wet ash management system at SHF to a dry storage system. On April 17, 2015, the EPA published the CCR Rule in the Federal Register. Under the CCR Rule, impoundments are potentially subject to a closure deadline of five years, with the possibility of an extension of the closure deadline under certain circumstances.

In June of 2016, TVA issued the *Final Ash Impoundment Closure Environmental Impact Statement, Part I – Programmatic NEPA Review* (Programmatic Environmental Impact Statement or PEIS) that analyzed methods for closing impoundments that hold CCR materials at TVA fossil plants system-wide and identified specific screening and evaluation factors to help frame assessment of closures at these facilities. A Record of Decision was released in July 2016 that allowed future environmental reviews of CCR impoundment closures to tier from the PEIS. A portion of the current SHF EIS is intended to tier from the 2016 PEIS to evaluate the closure alternatives for the existing CCR Ash Impoundment 2 impoundment. TVA will also analyze the impacts of the closure of the existing Special Waste Landfill, construction and operation of a new onsite CCR Landfill, or disposal of CCR at an offsite permitted landfill to accommodate future dry CCR disposal.

1.2 TVA's Objectives

As part of managing the disposal of CCR materials on a dry basis, and to meet new CCR regulations, TVA is proposing to cease operations at its existing Special Waste Landfill and Ash Impoundment 2 at SHF in accordance with the CCR Rule and state regulations, and construct and operate a new onsite dry CCR landfill.

The purpose of the EIS is to support TVA's goal to eliminate all wet storage at SHF, provide additional dry CCR material storage, and assist TVA in meeting state and federal regulations.

TVA must decide whether and how to close the Special Waste Landfill and Ash Impoundment 2, and whether to construct a new dry onsite CCR landfill, or dispose of dry CCR at an offsite permitted landfill. TVA's decision will consider factors such as potential environmental impacts, economic issues, availability of resources and TVA's long-term goals.

1.3 Proposed Alternatives

During initial project planning, a range of alternatives and specific screening criteria were identified for each of the proposed projects individually. They are: 1) closure of the existing special waste landfill and Ash Impoundment 2, and 2) landfill siting which included either construction and operation of a new dry CCR landfill, or use of an offsite existing permitted landfill. The alternatives considered but eliminated from further consideration will be described in the EIS.

The alternatives carried forward for analysis in the EIS include:

- **Alternative A: No Action** – TVA would continue current plant operations including continuing the operation of Ash Impoundment 2 and the existing Special Waste Landfill.
- **Alternative B: Construction and Operation of an Onsite Dry CCR Landfill and Closure of Existing Special Waste Landfill and Ash Impoundment 2** – TVA would construct a new dry CCR landfill on the SHF property, and would cease operations at and close the existing Special Waste Landfill and Ash Impoundment 2.
- **Alternative C: CCR Disposal at a Permitted Offsite Landfill and Closure of Existing Special Waste Landfill and Ash Impoundment 2** – TVA would cease operations at and close the existing Special Waste Landfill and Ash Impoundment 2, and would dispose of dry CCR produced by ongoing operations at SHF in an existing, permitted offsite landfill.

1.4 Environmental Review Process

NEPA requires federal agencies to consider and study the potential environmental consequences of major actions. The NEPA review process is intended to help federal agencies make decisions that are based on an understanding of the action's impacts and, if necessary, to take actions that protect, restore, and enhance the environment (40 Code of Federal Regulations [CFR] 1500.1(c)). NEPA also requires that federal agencies provide opportunities for public involvement in the decision-making process.

TVA is initiating the preparation of an EIS to assess the environmental impacts of the proposed actions. An EIS is the most intense level of NEPA review. During the completion of the EIS the public and environmental and permitting agencies have opportunities to provide input on the development of the environmental review. After considering input from the scoping period, TVA will develop and publish a Draft EIS that will be provided to the public and intergovernmental agencies for additional comment. During the public comment period on the Draft EIS, TVA plans to conduct a public meeting in the vicinity of SHF. TVA will consider all the comments it receives in the public review period on the Draft EIS, make revisions as appropriate, and publish a Final EIS. Comments on the Draft EIS will be addressed by TVA in the final EIS. TVA will make a final decision regarding the proposed project actions after the Final EIS is published.

During the initial public scoping period in November 2016, TVA estimated that the Draft EIS would be published in June 2017, the Final EIS would be published in December 2017, and a final decision would be made in January 2018.

1.5 Public Outreach During Scoping Period

On November 1, 2016, TVA published a Notice of Intent (NOI) in the Federal Register announcing that it planned to prepare an EIS to address the potential environmental effects associated with ceasing operations at the existing Special Waste Landfill and Ash Impoundment 2 and constructing, operating, and maintaining a new dry CCR landfill at SHF. The NOI initiated a 30-day public scoping period, which concluded on December 1, 2016. In addition to the NOI in the Federal Register, TVA sent notification of the NOI to local and state government entities and federal agencies, published notices regarding this effort in local newspapers; issued a news release to media; and posted the news release on the TVA Web site (See Appendix B).

TVA hosted a townhall scoping meeting on November 15, 2016, at the Robert Cherry Civic Center located at 2701 Park Avenue in Paducah, Kentucky. Notification of the townhall scoping meeting was sent to local residents within a one mile radius of the SHF plant, and also published in local newspapers. Local and regional stakeholders, governments, and other interested parties were also informed of the publication of the NOI and provided information about the scoping meeting. Materials from the townhall scoping meeting can be found in Appendix D.

The purpose of the scoping period and townhall meeting were to present TVA's project objectives and initial alternatives for input from the public and interested stakeholders.

1.6 Summary of Public Scoping Feedback

TVA received a wide variety of comments regarding the future management of CCR at SHF. TVA received a total of 51 comments from seven commenters. Of the seven submissions, one was from a federal entity, one was from a State entity, one was from a group of environmental organizations, and four were from members of the public. Comment submissions are included in Appendix C. TVA also received one request from an individual wishing to be added to the mailing list for future information about the project.

Comments were received in relation to the project purpose and need, alternatives, impact analysis, cumulative impacts, groundwater and surface water, aquatic ecology and threatened and endangered species, general environmental concerns, transportation, the NEPA Process and Scoping Meeting, and general topics. The comments related to TVA's proposed actions are addressed in the sections that follow. TVA also received four out-of-scope comments that are not related to the proposed actions. TVA will address these comments on an individual basis.

In addition, TVA received a copy of four comment submissions which had been previously submitted in relation to the Ash Impoundment Closure Programmatic Environmental Impact Statement process. Those four sets of comments have been previously addressed in Appendix A of the PEIS and are not addressed further in this document. The *Final Ash Impoundment Closure Environmental Impact Statement, Part I – Programmatic NEPA Review* is available on the TVA website at: https://www.tva.gov/Environment/Environmental-Stewardship/Environmental-Reviews.

1.6.1 Public Scoping Comments and Responses

1.6.2 Purpose and Need

Comment 1: TVA's purpose and need is too narrow. TVA must re-characterize the purpose and need to explore separating the analysis of closure of existing ash storage facilities at SHF to properly and adequately evaluate a reasonable range of alternatives in the EIS for both of these very different activities. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 1:** 40 CFR 1508.25 states, "To determine the scope of environmental impact statements, agencies shall consider 3 types of actions, 3 types of alternatives, and 3 types of impacts." Actions include: connected actions, cumulative actions, and similar actions. Similar actions, which when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography, so that an agency may wish to analyze these actions in the same impact statement. Furthermore, as stated on pages 5 and 6 of the commenter's submittal, NEPA requires TVA to identify connected actions which include actions that may automatically trigger other actions that require an EIS. TVA's purpose and need is to comply with the CCR Rule, and in order to fulfill that purpose and need, TVA must analyze the way CCR is stored at SHF. Analysis of the potential closure of the existing CCR storage areas drives the need for additional or alternative storage; thus, these actions are similar and are best analyzed together.

1.6.3 Alternatives

1.6.3.1 Retirement of SHF

Comment 2: TVA offers no explanation of why retirement of the coal-fired units at SHF would be technically or economically infeasible. Given the regulatory uncertainty and economic vulnerability associated with coal-fired generation, TVA must consider retirement of the coal-fired units at SHF as a reasonable alternative. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 2:** The purpose and need for the proposed action evaluated in this EIS is to help TVA meet its commitment to convert CCR storage from wet to dry, complement compliance with the CCR rule, and enhance compliance with the Effluent Limitation

Guidelines (ELG) rule. TVA is considering in depth three alternatives (listed in Section 1.3) to fulfill this purpose and need.

Retirement of SHF was not considered because it had been previously analyzed in TVA's 2014 EA for the installation of pollution controls on Shawnee Units 1 and 4 as well as in TVA's 2015 Integrated Resource Plan. Neither NEPA review recommended retirement of SHF.

In the 2014 EA, TVA concluded that continuing to operate SHF Units 1 and 4 was preferable to retiring them because continuing to operate the units furthered TVA's mission to provide reliable and affordable power, advanced TVA's goal of maintaining a balanced portfolio of generation resources, and preserved two units on the TVA system that have unique value because of their load-following capabilities, their fuel diversity, and their low operating costs.

While the 2015 Integrated Resource Plan did recommend continuing with the announced unit retirements at Allen, Colbert, Johnsonville, Paradise and Widows Creek, it did not include SHF in this unit retirement group. Instead, the Integrated Resource Plan recommended that retirement of SHF be evaluated in the mid-2020s if additional environmental controls were required.

Comment 3: TVA's statement of purpose in the NOI establishes additional storage and ash management activities as a foregone conclusion and precludes the consideration of reasonable alternatives, including cessation of coal-fired generation at SHF. TVA must consider retirement of SHF as a reasonable alternative to the proposed action. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 3: See response to Comments 1 and 2.

Comment 4: It is not clear from the description of the No Action Alternative in the Scoping Notice how TVA plans to analyze the environmental consequences associated with continuing to dispose of CCR in disposal areas that are likely to trigger corrective action under federal law. This could lead to temporary or permanent cessation of coal-fired generation at SHF. Therefore, in evaluating the No Action Alternative, TVA must take into account the impacts of temporary or permanent cessation of coal-fired generation at SHF. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 4: TVA will take into account all reasonable consequences of the No Action Alternative in the EIS impacts analysis. The purpose of the No Action Alternative is to provide a benchmark or baseline from which the proposed action and alternatives can be assessed. It is supposed to reflect the status quo or current conditions. TVA acknowledges that there are regulatory requirements that affect how TVA currently disposes of CCR at SHF and that to continue to do so could potentially trigger corrective action including cessation of plant operations. However, the status quo includes SHF's current CCR disposal processes. The

Council on Environmental Quality in its “40 Most Asked Questions” publication (46 Fed. Reg. 18026, 18027 (March 23, 1981) specifically addresses this kind of situation. CEQ states that an agency should evaluate taking no action even if it 'is under a court order or legislative command to act.' Thus, assuming continuation of current CCR disposal best captures current conditions and is an appropriate No Action Alternative.

1.6.3.2 Ash Impoundment 2 Closure

Comment 5: The Scoping Notice provided very little information regarding the project alternatives which TVA plans to consider in the EIS. Closure of Ash Impoundment 2 by removal of CCRs, one of the two options outlined in the CCR rule, must be considered. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 5:** The EIS will address two options for closing Ash Impoundment 2 and the existing Special Waste Landfill: closing in place and closing by removal.

Comment 6: TVA will be required by law to close Ash Impoundment 2 and other coal ash disposal areas because it is built below the water table. This is a connected and cumulative action, and TVA must provide a detailed plan, including a timeline, for closure of that impoundment and those disposal areas in the EIS. Since Ash Impoundment 2 and those other disposal areas are saturated with groundwater, the only environmentally safe way of closure is to remove all of the ash. The EIS must specifically explain how and when this will happen and identify potential permanent storage options for the ash once it is removed. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 6:** The EIS is evaluating the option of closing Ash Impoundment 2 and the existing Special Waste Landfill in accordance with the CCR rule. TVA will include a description of the closure activities and timeline in the EIS to facilitate the impact analysis. Closure by removal is being addressed in the EIS as is closure by reduced footprint.

1.6.4 Impact Analysis

Comment 7: As identified in TVA’s notice, we agree that the following environmental impact analysis must be included in the EIS: (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

- Water resources (surface water, groundwater quality, and use)
- Vegetation
- Wildlife
- Aquatic ecology
- Endangered and threatened species
- Floodplains and wetlands

- Geology
- Land use
- Transportation
- Recreational and managed areas
- Visual resources
- Archaeological and historic resources
- Solid and hazardous waste
- Public health and safety
- Noise
- Air quality and climate change
- Socioeconomics and environmental justice

Response 7: Comment noted.

Comment 8: TVA must describe in sufficient detail the affected environment (baseline) conditions and the No Action Alternative. The public must be informed about the extent of contamination at SHF under the baseline condition to form educated opinions about environmental impacts of alternatives. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 8: In the EIS TVA will fully describe the existing baseline conditions at SHF, the No Action Alternative, and will fully examine the environmental impacts associated with each alternative, including the No Action Alternative.

Comment 9: At a minimum, TVA must fully characterize the existing coal ash deposits at the site and the groundwater, surface water, soil, sediment, and air contamination being caused by these deposits; model future contamination through each of the above-named exposure pathways under each alternative, including the No Action Alternative; and explain how it intends to remediate existing contamination as required by federal law. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 9: See response to Comment 8.

Comment 10: TVA must explain in detail how each of the alternatives that it evaluates will impact the baseline condition and the baseline risk, including groundwater quality and surface water quality. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 10: See response to Comment 8.

1.6.5 Cumulative Impacts

Comment 11: The Scoping Notice does not identify any connected or cumulative actions that will be analyzed in the EIS. Nor does it identify any cumulative impacts. Cumulative impacts that must be analyzed in the EIS include: (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

- Coal mining, including any coal sourced from mines that engage in mountain-top removal
- Transportation of coal to SHF
- Coal combustion, including impacts from common air pollutants and carbon pollutants
- Dewatering, including water quality impacts
- Storage, including water quality impacts from existing coal ash impoundments and fugitive dust from existing dry storage
- Impact on wildlife and endangered species

Response 11: Impacts associated with coal mining, transportation of coal to SHF, and coal combustion have been considered in various previous environmental analyses and serve as existing conditions to the current proposed actions. Impacts associated with dewatering were considered in the *Shawnee Fossil Plant Bottom Ash Process Dewatering Facility Final Environmental Assessment* (TVA 2016). Cumulative impacts associated with construction of the bottom ash process dewatering facility in conjunction with the current proposed action will be considered in this EIS. Impacts associated with storage of coal ash and fugitive dust from dry storage and impacts on wildlife and endangered species will be considered in this EIS. Additional foreseeable future actions will also be identified in this EIS.

Comment 12: The cumulative impacts associated with replicating the proposed action across its fleet, including the above mentioned cumulative impacts, should be analyzed in the EIS. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 12: The cumulative impacts associated with closure of ash impoundments across the TVA fleet were considered in the *Final Ash Impoundment Closure Environmental Impact Statement* (PEIS) (TVA 2016) and will be considered as appropriate in this EIS and other NEPA analyses which tier from the PEIS.

1.6.6 Aquatic Ecology/Threatened and Endangered Species

Comment 13: The U.S. Fish and Wildlife Service would prefer project design options that minimize impacts to federally-listed species, particularly freshwater mussels. The potential of the proposed project to impact federally-listed mussel species, as a result of impacts to water quality both in the construction (e.g. run-off during construction) and operational phases (e.g. contaminants from the landfill) should be considered in the EIS. (*Commenter: U.S. Fish and Wildlife Service*)

Response 13: The EIS will thoroughly evaluate the potential of the proposed project to impact any federally listed species within the proposed project area, including mussels. TVA maintains a robust environmental assessment program at all of its power plants including groundwater, surface water, and ecological monitoring. This program has been ongoing for many years and the program data has not indicated any harm to aquatic species. This is also supported by whole effluent toxicity testing at TVA's NPDES outfalls which demonstrates no toxicity to aquatic life. These analyses also found no contamination above screening levels.

Comment 14: Current species lists for the proposed project area can be obtained from the U.S. Fish and Wildlife Service Information for Planning and Conservation (IPaC) system. (*Commenter: U.S. Fish and Wildlife Service*)

Response 14: TVA has used the IPaC system to obtain current species lists for the proposed project area.

1.6.7 Groundwater and Surface Water

Comment 15: If TVA were to adopt the No Action Alternative, it would be perpetuating site-wide groundwater contamination by continuing to add coal ash to disposal areas that are known to be leaking. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 15: See response to Comment 4. Applicable regulations require the consideration of a No Action Alternative that reflects current conditions to provide a baseline for potential changes to environmental resources. For TVA, the No Action Alternative is the baseline for comparing changes resulting from the action alternatives. TVA agrees that the No Action alternative would not meet TVA's plan for conversion to dry CCR storage. TVA monitors groundwater quality at SHF in accordance with all applicable federal, state, and local regulations. Groundwater monitoring reports are submitted to the state regulatory agency twice a year. Since 2011, there have been no exceedances of EPA Maximum Contaminant Levels (MCLs), which are drinking water standards.

Comment 16: TVA has failed to admit the legacy of contaminated groundwater across all of its coal facilities. Existing coal ash disposal also presents risks to human health and the environment through air, soil, surface water, and sediment exposure pathways. TVA must evaluate the risks that these exposure pathways pose currently, and must also evaluate the extent of the risks associated with new disposal areas. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 16: In the EIS, TVA will describe existing baseline conditions for groundwater quality at SHF. These baseline conditions will form the foundation from which impacts associated with the proposed project alternatives will be evaluated. TVA conducts comprehensive ecological and water quality monitoring that indicates no adverse impact to ecological communities from the operation of SHF. Risks to human health and the environment, including air, soil, surface water, and sediment will be addressed in the EIS analysis for both the No Action alternative (current conditions) and all proposed project alternatives, including new disposal areas.

Comment 17: TVA is also considering hauling coal ash to an existing permitted landfill. If that landfill is the existing, onsite coal ash landfill, TVA should directly address the ongoing groundwater contamination at that landfill, explain how it happened, and explain in detail how they will prevent it from happening in an expansion. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 17: The reference to an alternative of hauling coal ash to an existing permitted landfill was intended to reflect an offsite, existing, third-party landfill.

Comment 18: TVA should provide an honest assessment of the extent of coal ash-related groundwater contamination at SHF similar to that provided in the February 2014 groundwater monitoring report for SHF. TVA must be transparent about the extent, cause, and remedial implications of the contamination. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 18: See responses to Comments 15 and 16.

Comment 19: The disposal of coal ash at SHF has caused widespread and severe groundwater contamination. This is likely to continue if the ash is left in place after closure, particularly if any ash is left below the water table. If TVA leaves ash buried beneath the water table, the aquifers will be unsafe for human use for thousands of years. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 19: See responses to Comments 15 and 16.

Comment 20: TVA must assess the degree to which coal ash is and will be saturated with groundwater. Previous reports indicate that a significant portion of the coal ash at SHF is beneath the water table, saturated, and constantly leaching pollutants into local groundwater and surface water. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 20: See responses to Comments 15 and 16.

Comment 21: TVA must assess the risks to future inhabitants of the area who may wish to use the groundwater. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 21: See responses to Comments 15 and 16. TVA will consider the impacts to current and future uses associated with groundwater quality in the EIS.

Comment 22: The SHF fly ash impoundment which is partially buried beneath the water table fails the April 2015 EPA coal ash disposal regulation under the Resource Conservation and Recovery Act (RCRA) and must therefore be closed. TVA must also demonstrate that any new coal ash landfill is at least five feet above local groundwater. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 22: TVA is examining the requirements of the April 2015 EPA CCR regulations as it relates to the Ash Impoundment 2 CCR impoundment and the alternatives for closing Ash Impoundment 2 in this EIS. TVA would comply with all applicable federal, state, and local regulations including the CCR Rule, in the design and operation of a new coal ash landfill.

Comment 23: New coal ash landfills must have composite liners and leachate collection systems. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 23: Any proposed new dry CCR landfill which TVA considers in this EIS would be in compliance with all regulatory requirements.

Comment 24: TVA must design and maintain run-on and run-off control systems for all coal ash landfills. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 24: TVA currently maintains run-on and run-off control systems for the existing Special Waste Landfill and Ash Impoundment 2. TVA will continue to maintain required run-on and run-off control systems for the selected alternative.

Comment 25: TVA must monitor the groundwater around all active coal ash disposal areas for boron, calcium, chloride, fluoride, pH, sulfate, and Total Dissolved Solids (TDS). If monitoring at downgradient groundwater wells show any of these parameters at concentrations that exceed background, TVA must also monitor for antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226/228. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 25: See responses to Comments 15 and 16. TVA currently conducts groundwater monitoring in accordance with all applicable federal, state, and local regulations and will continue to do so as required for the selected alternative.

Comment 26: Existing, unlined surface impoundments must be closed if they cause assessment monitoring constituents to exceed the groundwater standards prescribed by the

RCRA rule. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 26:** See responses to Comments 15 and 16. TVA will consider the existing groundwater quality in this EIS. TVA is examining the alternative of closing the existing Special Waste Landfill and Ash Impoundment 2 in this EIS and will consider all potential impacts associated with this action as well as the No Action Alternative.

Comment 27: For all landfills that cause assessment monitoring exceedances, TVA must undertake corrective measures of prevention, remediation, and restoration. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 27:** See responses to Comments 15 and 16. TVA is currently in compliance with all monitoring requirements. TVA would take appropriate actions for prevention, remediation, and restoration under RCRA and all applicable federal, state, and local regulations should an exceedance occur.

Comment 28: The RCRA rule also provides requirements for how TVA must close its coal ash disposal areas, including requirements for post-closure care. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 28:** TVA would comply with all applicable federal, state, and local regulations, including RCRA, in relation to the closure of the existing Special Waste Landfill and Ash Impoundment 2.

Comment 29: TVA already has data showing elevated concentrations of boron in Little Bayou Creek. TVA must, therefore, evaluate the future risk to surface water and sediment from boron and other coal ash-related pollutants under each scenario and each closure option. At a minimum, TVA must evaluate the risks associated with EPA's pollutants of concern for ecological receptors boron and cadmium. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 29:** See responses to Comments 15 and 16. TVA is required by state permitting authorities to manage its discharges in a manner that maintains in-stream water quality standards for the receiving waters. Meeting water quality standards means that human health and aquatic life uses of the stream are protected. When dewatering ash impoundments for closure, TVA must demonstrate that discharges will continue to meet NPDES permit limits and that water quality standards in the receiving stream will be protected. TVA also conducts monitoring at greater frequencies than required by the NPDES permit when conducting dewatering activities. TVA has plans in place to provide additional treatment to discharges when warranted to maintain water quality standards in

surface waters. In the EIS, TVA will consider the impacts to surface water and sediment based on existing, known, baseline conditions for each alternative and closure option.

Comment 30: TVA must evaluate the risks presented by manganese leachate. EPA has identified manganese leachate as a coal ash pollutant. There is a clear difference in concentrations between upgradient and downgradient wells indicating that the coal ash disposal areas are responsible for this difference. With concentrations above the EPA Lifetime Health Advisory for manganese, the affected groundwater is hazardous to human health. It may also be hazardous to aquatic life as it leaches in Little Bayou Creek and the Ohio River. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 30: See responses to Comments 15, 16, 26, and 29.

Comment 31: It is very likely that boron, cadmium, and manganese (and potentially other pollutants as well) currently present risks to the local ecosystem and will continue to do so if the ash disposal area is closed in place. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 31: See responses to Comments 15, 16, and 26.

Comment 32: For each disposal area, TVA must fully characterize groundwater contamination using the now well-known indicators of coal ash pollution – boron, sulfate, Total Dissolved Solids (TDS), and the other pollutants listed in Appendix III of the RCRA coal ash rule. For each of these pollutants, TVA must assess upgradient and downgradient groundwater quality and identify all downgradient exceedances. Wells must be located appropriately. To the extent that existing data are sufficient and appropriate, TVA must use that existing data in its analysis. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 32: See responses to Comments 15 and 16. TVA currently monitors upgradient and downgradient wells in compliance with all applicable federal, state and local regulations including RCRA. TVA will use that data in the EIS analysis for all project alternatives with regard to groundwater quality and impacts on human health and the environment.

Comment 33: Contaminated groundwater at SHF is migrating into Little Bayou Creek and the Ohio River through subsurface flow and seeps. This presents a public health threat to any downstream consumers of the water as well as an ecological threat. TVA must provide long-term modeling of this pollution pathway to provide the public a meaningful sense of how significant this pollution load is going to be over the coming decades. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 33: See responses to Comments 15, 16, and 29.

Comment 34: TVA must continue to monitor surface water in Little Bayou Creek for an expanded list of pollutants, immediately upstream and downstream of the plant, using methods that are sufficiently sensitive to detect pollutants of concern. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 34:** See responses to Comments 15, 16, and 29. TVA continues to conduct surface water sampling in accordance with all applicable federal, state, and local regulations.

Comment 35: Many of the metals that are being discharged into the surface waters settle out into sediment, and risk assessments have demonstrated a clear risk to ecological receptors through sediment exposure. TVA must sample the sediment along both shorelines, and compare sediment sampling results to appropriate risk-based thresholds for sediment quality. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 35:** See responses to Comments 15, 16, and 29.

Comment 36: To the extent that any of the sampling analyses for groundwater, surface water, and sediment show a risk to human health or ecological integrity, TVA must explain how it intends to restore the area to its original condition. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 36:** See responses to Comment 15, 16, and 29.

1.6.8 General Environment

Comment 37: The options that TVA is considering for dry ash handling touch on all existing ash disposal areas, therefore the EIS must fully evaluate the environmental impacts of coal ash site-wide. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 37:** TVA will fully evaluate the environmental impacts of all coal ash associated with the project alternatives.

Comment 38: A new landfill will have to conform to the requirements of EPA’s new Resource Conservation and Recovery Act (RCRA) Subtitle D rule for coal ash. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

> **Response 38:** See responses to Comments 22 and 23.

Comment 39: TVA does not want people to know that this proposal would pollute the land and water and cause harm to the health of people and wildlife in the area. (*Commenter: Phyllis Robertson*)

Response 39: NEPA has twin aims which are to oblige agencies to consider significant aspects o the environmental impact of a proposed action and to ensure that the agency informs the public that it has considered environmental concerns in its decision-making process. TVA is undertaking this NEPA review to fulfill NEPA's twin aims. TVA will consider all potential environmental impacts to land, water, people, and wildlife in the EIS. The Draft EIS will be made available for public comment. The Final EIS will also be shared with the public.

Comment 40: New coal ash disposal areas cannot be built in wetlands, fault areas, or seismic impact zones. New coal ash disposal areas cannot be built in geologically unstable areas, such as areas with karst bedrock. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 40: TVA will consider the impacts to wetlands and geology in the EIS. TVA will determine if fault areas, seismic zones, geological stability issues, and/or karst features are present and if these geologic conditions render any stability concerns.

Comment 41: TVA must prepare and follow fugitive dust control plans for all coal ash disposal areas. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 41: TVA currently follows fugitive dust control plans for operations at SHF. TVA would revise this plan as needed to accommodate the selected alternative.

Comment 42: TVA should consider the effects of increased extreme weather events on decisions made regarding both the closure of SHF ash storage facilities as well as the construction of future dry ash storage faculties on site. TVA is required to consider the impacts of increased storm-related flooding as well as the risk of catastrophic waste washout or other releases of CCR to surface waters. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 42: TVA takes extreme weather events, including flood risks, into account during the design and planning process. TVA's closure plans for Ash Impoundment 2 and the existing Special Waste Landfill as well as for the new dry CCR landfill would be designed to reduce the risk of catastrophic failures during flooding. In addition, TVA conducts analyses dealing with the probability maximum flood within its dam safety program and takes action to address unacceptable risks. TVA would review and apply these analyses as appropriate with respect to the proposed actions.

Comment 43: Several exposure pathways begin with fugitive dust. TVA must estimate these risks and explain how it will control fugitive dust under each alternative. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 43: TVA will evaluate and consider fugitive dust and use of measures to control fugitive dust with respect to each alternative.

1.6.9 Transportation

Comment 44: Any proposed access or encroachment of a State maintained road right-of-way should be coordinated at the earliest stage with the Kentucky Department of Highways, District 1. TVA will also require a permit from the Kentucky Department of Highways for any type of work (including signage, boring, etc.) on or adjacent to a State right-of-way. (*Commenter: Kentucky State Clearinghouse*)

Response 44: TVA has initiated consultation with the Kentucky Department of Highways regarding the proposed actions. The results of this consultation will be reported in the EIS. TVA would obtain a permit from the Kentucky Department of Highways if appropriate once the preferred alternative is selected and construction plans are finalized.

1.6.10 NEPA Process/Scoping Meeting Process

Comment 45: TVA staff at the public meeting did not provide answers to questions and could not explain the maps. For example, they did not know when they would dump the fly ash. (*Commenters: Larry Adams and Phyllis Robertson*)

Response 45: TVA staff at the public meeting was prepared to answer all questions related to the current proposed actions. However, the initiation of project activities is undetermined at this time because the project schedule is based on the completion of all appropriate environmental reviews, project design decisions, and TVA decision-making. TVA staff explained this situation at the public meeting.

Comment 46: TVA could have handed out information at the scoping meeting that would explain the process of CCR, such as the CCR report on the SHF website. (*Commenter: Phyllis Robertson*)

Response 46: TVA had material related to the current project available at the scoping meeting. TVA will include links to additional materials on handouts at future meetings.

1.6.11 General Comments

Comment 47: As TVA notes in the request for comments, the TVA Board of Directors decided to phase out wet handling and storage of fly ash six years ago. We strongly support that decision and remain hopeful that TVA will accomplish the goal as soon as possible. (*Commenters: Southern Alliance for Clean Energy, Sierra Club Environmental Law Program, Environmental Integrity Project, and Earthjustice Coal Program Office*)

Response 47: Comment noted.

Comment 48: The Kentucky Heritage Council/State Historical Preservation Office (SHPO) directed TVA to their website for required documents and the Section 106 Review and Compliance for 36 CFR Part 800 process. (*Commenter: Kentucky State Clearinghouse*)

> **Response 48:** TVA has already initiated consultation with the Kentucky Heritage Council/SHPO in accordance with the standard process. The results of this consultation will be reported in the EIS.

Comment 49: The Kentucky Department for Natural Resources has found no major concerns from the review of the proposed project as presented other than those stated as conditions or comments. (*Commenter: Kentucky State Clearinghouse*)

> **Response 49:** Comment noted.

Comment 50: The Kentucky Department of Housing, Buildings, and Construction, the Kentucky Department of Fish and Wildlife Resources, and Purchase Area Development District had no comments. (*Commenters: Kentucky State Clearinghouse*)

> **Response 50:** Comment noted.

Comment 51: The Kentucky Labor Cabinet commented that state prevailing wage rates may apply to projects exceeding $250,000. (*Commenter: Kentucky State Clearinghouse*)

> **Response 51:** TVA would comply with all appropriate federal, state, and local wage regulations.

1.6.12 Out of Scope Comments

TVA also received four out-of-scope comments that are not related to the proposed actions. TVA will address these comments on an individual basis.

Appendix A: Federal Register Notice of Intent

This page intentionally left blank

Administration, 409 3rd Street, 6th Floor, Washington, DC 20416.

FOR FURTHER INFORMATION CONTACT: Louis Cupp, New Markets Policy Analyst, 202–619–0511 *louis.cupp@sba.gov* Curtis B. Rich, Management Analyst, 202–205–7030 *curtis.rich@sba.gov.*

SUPPLEMENTARY INFORMATION: Reporting and recordkeeping requirements, Investment companies, Finance, Business/Industry, Small Business. Conduct standards.

Solicitation of Public Comments

SBA is requesting comments on (a) Whether the collection of information is necessary for the agency to properly perform its functions; (b) whether the burden estimates are accurate; (c) whether there are ways to minimize the burden, including through the use of automated techniques or other forms of information technology; and (d) whether there are ways to enhance the quality, utility, and clarity of the information.

Title: Financing Eligibility Statement—Social Disadvantage/Economic: Disadvantage.

Frequency: On Occasion.

SBA Form Numbers: 1941A, 1941B, 1941C.

Description of Respondents: Small Business Investment Companies and Small Businesses.

Responses: 10.

Annual Burden: 15.

Curtis Rich,

Management Analyst.

[FR Doc. 2016–26294 Filed 10–31–16; 8:45 am]

BILLING CODE 8025–01–P

SMALL BUSINESS ADMINISTRATION

Disaster Declaration #14932 and #14933

Wisconsin Disaster # WI–00056

AGENCY: U.S. Small Business Administration.

ACTION: Notice.

SUMMARY: This is a Notice of the Presidential declaration of a major disaster for Public Assistance Only for the State of Wisconsin (FEMA–4288–DR), dated 10/20/2016.

Incident: Severe Storms, Flooding, and Mudslides.

Incident Period: 09/21/2016 through 09/22/2016.

Effective Date: 10/20/2016.

Physical Loan Application Deadline Date: 12/19/2016.

Economic Injury (EIDL) Loan Application Deadline Date: 07/20/2017.

ADDRESSES: Submit completed loan applications to: U.S. Small Business Administration, Processing and Disbursement Center, 14925 Kingsport Road, Fort Worth, TX 76155.

FOR FURTHER INFORMATION CONTACT: A. Escobar, Office of Disaster Assistance, U.S. Small Business Administration, 409 3rd Street SW., Suite 6050, Washington, DC 20416.

SUPPLEMENTARY INFORMATION: Notice is hereby given that as a result of the President's major disaster declaration on 10/20/2016, Private Non-Profit organizations that provide essential services of governmental nature may file disaster loan applications at the address listed above or other locally announced locations.

The following areas have been determined to be adversely affected by the disaster:

Primary Counties: Adams, Chippewa, Clark, Crawford, Jackson, Juneau, La Crosse, Monroe, Richland, Vernon.

The Interest Rates are:

	Percent
For Physical Damage:	
Non–Profit Organizations With Credit Available Elsewhere	2.625
Non–Profit Organizations Without Credit Available Elsewhere	2.625
For Economic Injury:	
Non–Profit Organizations Without Credit Available Elsewhere	2.625

The number assigned to this disaster for physical damage is 14932B and for economic injury is 14933B.

(Catalog of Federal Domestic Assistance Number 59008)

Lisa Lopez-Suarez,

Acting Associate Administrator for Disaster Assistance.

[FR Doc. 2016–26286 Filed 10–31–16; 8:45 am]

BILLING CODE 8025–01–P

TENNESSEE VALLEY AUTHORITY

Environmental Impact Statement for Shawnee Fossil Plant Coal Combustion Residual Management

AGENCY: Tennessee Valley Authority.

ACTION: Notice of intent.

SUMMARY: The Tennessee Valley Authority (TVA) intends to prepare an environmental impact statement (EIS) to address the potential environmental effects associated with ceasing operations at the special waste landfill and Ash Pond 2 and constructing, operating, and maintaining a new dry coal combustion residual (CCR) landfill at the Shawnee Fossil Plant (SHF) located near Paducah, Kentucky in McCracken County. The purpose of the proposed project is to foster TVA's compliance with present and future regulatory requirements related to CCR production and management, including the requirements of EPA's CCR Rule and Effluent Limitations Guidelines Rule.

In the environmental review, TVA will evaluate the potential environmental impacts of closure of the special waste landfill and Ash Pond 2 as well as the construction, operation, and maintenance of an onsite dry CCR landfill or disposal of CCR in an existing offsite permitted landfill. TVA will develop and evaluate various alternatives, including the No Action Alternative, in the EIS. Public comments are invited concerning both the scope of the review and environmental issues that should be addressed.

DATES: To ensure consideration, comments on the scope and environmental issues must be postmarked, emailed or submitted online no later than December 1, 2016.

ADDRESSES: Written comments should be sent to Ashley Pilakowski, NEPA Compliance Specialist, 400 West Summit Hill Dr., WT 11D, Knoxville, TN 37902–1499. Comments may also be submitted online at: *www.tva.gov/nepa.*

FOR FURTHER INFORMATION CONTACT: Ashley Pilakowski, 865–632–2256.

SUPPLEMENTARY INFORMATION: This notice of intent is provided in accordance with the Council on Environmental Quality's regulations (40 CFR parts 1500–1508) and TVA's procedures implementing the National Environmental Policy Act (NEPA).

TVA Power System and CCR Management

TVA is a corporate agency of the United States that provides electricity for business customers and local power distributors serving more than 9 million people in parts of seven southeastern states. TVA receives no taxpayer funding, deriving virtually all of its revenues from sales of electricity. In addition to operating and investing its revenues in its electric system, TVA provides flood control, navigation and land management for the Tennessee River system and assists local power companies and state and local governments with economic development and job creation.

Historically, TVA has managed its CCRs in wet impoundments or dry landfills. Currently, SHF consumes an average of 3,880,165 tons of coal per year, generates approximately 8 billion kilowatt-hours of electricity a year (enough to supply 540,000 homes), and produces approximately 256,000 tons of CCR a year which are managed in an existing special waste landfill and a pond (Ash Pond 2).

In July 2009, the TVA Board of Directors passed a resolution for staff to review TVA practices for storing CCRs at its generating facilities, including SHF, which resulted in a recommendation to convert the wet ash management system at SHF to a dry storage system. On April 17, 2015, the U.S. Environmental Protection Agency (EPA) published the final Disposal of CCRs from Electric Utilities rule.

In June of 2016, TVA issued a Final Programmatic Environmental Impact Statement (PEIS) that analyzed methods for closing impoundments that hold CCR materials at TVA fossil plants and identified specific screening and evaluation factors to help frame its evaluation of closures at additional facilities. A Record of Decision was released in July of 2016 that would allow future environmental reviews of CCR impoundment closures to tier from the PEIS.

This EIS is intended to tier from the 2016 PEIS to evaluate the closure alternatives for the existing CCR Ash Pond 2 impoundment and additionally analyze the impacts of the closure of the existing special waste landfill, and construction, operation, and maintenance of a new on-site special waste landfill to accommodate future dry CCR disposal actions. This project supports TVA's goal to eliminate all wet CCR storage at SHF.

Alternatives

In addition to a No Action Alternative, this EIS will address alternatives that have reasonable prospects of providing a solution to the management and disposal of dry CCRs generated at SHF. TVA has determined that either the construction of a new CCR storage area or hauling CCR to an existing permitted landfill are the most reasonable alternatives to address the need for additional dry CCR disposal. TVA will consider closure alternatives for Ash Pond 2 in accordance with and consistent with TVA's PEIS and EPA's CCR Rule. TVA will also consider closure alternatives for the existing special waste landfill in accordance with EPA's CCR Rule.

No decision has been made about CCR management at SHF beyond the current operations and available onsite capacity. TVA is preparing this EIS to inform decision makers, other agencies and the public about the potential for environmental impacts associated with the decision on how to manage CCR generated at SHF.

Proposed Issues To Be Considered

This EIS will contain descriptions of the existing environmental and socioeconomic resources within the area that could be affected by the closure of the special waste landfill and Ash Pond 2 and by the construction, operation and maintenance of a new dry CCR landfill or disposal of CCR at an offsite landfill. Evaluation of potential environmental impacts to these resources will include, but not be limited to, the potential impacts on water quality, aquatic and terrestrial ecology, threatened and endangered species, wetlands, land use, historic and archaeological resources, solid and hazardous waste, safety, socioeconomic resources and environmental justice. The need and purpose of the project will be described. The range of issues to be addressed in the environmental review will be determined, in part, from scoping comments. The preliminary identification of reasonable alternatives and environmental issues in this notice is not meant to be exhaustive or final.

Public and Agency Participation

TVA is interested in an open process and wants to hear from the community, interested agencies and special interest groups about the scope of issues they would like to see addressed in this EIS.

The public is invited to submit comments on the scope of this EIS no later than the date identified in the "Dates" section of this notice. Federal, state and local agencies such as the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, Kentucky Department of Environmental Protection, and the Kentucky State Historic Preservation Officer also are invited to provide comments. After consideration of scoping comments, TVA will post a summary of them and identify the issues and alternatives to be addressed in the EIS and the study's schedule.

The Draft EIS will be made available for public comment. In making its final decision, TVA will consider the analyses in this EIS and substantive comments that it receives. A final decision on proceeding with pond closure, existing landfill closure, and construction, operation, and maintenance of a new landfill will depend on a number of factors. These include requirements of the CCR Rule, the results of the EIS, engineering and risk evaluations, and financial considerations.

TVA anticipates holding a community meeting near the plant after releasing the Draft EIS. Meeting details will be posted on TVA's Web site. TVA expects to release the Draft EIS in summer of 2017.

M. Susan Smelley,

Director, Environmental Permitting and Compliance.

[FR Doc. 2016–26272 Filed 10–31–16; 8:45 am]

BILLING CODE P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Agency Information Collection Activities: Requests for Comments; Clearance of Renewed Approval of Information Collection: Aviation Insurance

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice and request for comments.

SUMMARY: In accordance with the Paperwork Reduction Act of 1995, FAA invites public comments about our intention to request the Office of Management and Budget (OMB) approval to renew a previously approved information collection. The requested information is included in air carriers applications for insurance when insurance is not available from private sources.

DATES: Written comments should be submitted by January 3, 2017.

ADDRESSES: Send comments to the FAA at the following address: Ronda Thompson, Federal Aviation Administration, ASP–110, 800 Independence Ave. SW., Washington, DC 20591.

PUBLIC COMMENTS INVITED: You are asked to comment on any aspect of this information collection, including (a) Whether the proposed collection of information is necessary for FAA's performance; (b) the accuracy of the estimated burden; (c) ways for FAA to enhance the quality, utility and clarity of the information collection; and (d) ways that the burden could be minimized without reducing the quality of the collected information. The agency will summarize and/or include your comments in the request for OMB's clearance of this information collection.

FOR FURTHER INFORMATION CONTACT: Ronda Thompson by email at: *Ronda.Thompson@faa.gov.*

SUPPLEMENTARY INFORMATION:

OMB Control Number: 2120–0514.

Title: Aviation Insurance.

Appendix B: Transmittal Letter, Meeting Notice Newspaper Advertisements, and Media Release

This page intentionally left blank

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

October 28, 2016

TO WHOM IT MAY CONCERN:

NOTICE OF INTENT TO PREPARE AN ENVIRONMENTAL IMPACT STATEMENT – SHAWNEE FOSSIL PLANT COAL COMBUSTION RESIDUAL MANAGEMENT

The Tennessee Valley Authority (TVA) has submitted a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) to address the potential environmental effects associated with ceasing operations at the special waste landfill and Ash Pond 2, and building and operating a new dry coal combustion residual (CCR) landfill at the Shawnee Fossil Plant (SHF) located near Paducah, Kentucky in McCracken County. TVA is seeking comment on the scope of the proposed project. To ensure consideration, comments on the scope of the EIS must be postmarked or e-mailed no later than December 1, 2016.

In addition to a No Action Alternative, the EIS will address alternatives that have reasonable prospects of providing a solution to the management and disposal of dry CCRs generated at SHF. TVA has determined that either the construction of a new CCR storage area or hauling CCR to an existing permitted landfill are the most reasonable alternatives to address the need for additional dry CCR disposal. TVA will consider closure alternatives for Ash Pond 2 in accordance with and consistent with TVA's 2016 Programmatic EIS and Environmental Protection Agency's Disposal of Coal Combustion Residuals from Electric Utilities rule (CCR Rule). TVA will also consider closure alternatives for the existing special waste landfill in accordance with EPA's CCR Rule.

Written comments should be sent to Ashley Pilakowski, NEPA Compliance Specialist, 400 West Summit Hill Dr., WT 11D, Knoxville, TN 37902-1499. Comments may also be submitted online at: www.tva.gov/nepa. If you have any questions, please contact Ashley Pilakowski at (865) 632-2256 or aapilakowski@tva.gov.

Sincerely,

Amy B. Henry
Manager, NEPA Program & Valley Projects

Enclosure

Request for Public Comment

TVA

Coal Combustion Residuals Management Projects for Shawnee Fossil Plant

TVA requests your comments on the scope of its environmental impact statement (EIS) on the Shawnee Fossil Plant (SHF) Coal Combustion Residuals (CCR) Management projects. The plant is located in McCracken County, Ky. Comments must be received by Dec. 1, 2016.

A portion of this EIS is intended to tier from TVA's 2016 Programmatic Environmental Impact Statement (PEIS) that analyzed methods for closing CCR impoundments at TVA fossil plants system-wide and identified specific screening and evaluation factors to help frame its assessment of closures at additional facilities. TVA will evaluate the closure alternatives for the existing CCR Ash Pond 2, analyze the impacts of the closure of the existing special waste landfill and assess the construction and operation of a new on-site special waste landfill to accommodate future dry CCR disposal.

This project supports TVA's goal to eliminate all wet CCR storage across its system and will meet the requirements of the U.S. Environmental Protection Agency's CCR Rule and state permitting requirements.

Comments on the scope of this EIS must be received no later than Dec. 1, 2016. They may be submitted online at tva.gov/nepa, mailed or emailed to the address below. All comments received, including names and addresses, will become part of the project administrative record and will be available for public inspection.

Ashley Pilakowski
NEPA Compliance Specialist
Tennessee Valley Authority
400 West Summit Hill Dr., WT 11D
Knoxville, TN 37902
aapilakowski@tva.gov

Pub: Paducah Sun
Size: 4.75" x 7"
Insert: 10/31

Client: TVA
Job No: TVA4-55824
Title: Shawnee Fossil Ash Pond

Request for Public Comment

TVA

Coal Combustion Residuals Management Projects for Shawnee Fossil Plant

TVA requests your comments on the scope of its environmental impact statement (EIS) on the Shawnee Fossil Plant (SHF) Coal Combustion Residuals (CCR) Management projects. The plant is located in McCracken County, Ky. Comments must be received by Dec. 1, 2016.

A portion of this EIS is intended to tier from TVA's 2016 Programmatic Environmental Impact Statement (PEIS) that analyzed methods for closing CCR impoundments at TVA fossil plants system-wide and identified specific screening and evaluation factors to help frame its assessment of closures at additional facilities. TVA will evaluate the closure alternatives for the existing CCR Ash Pond 2, analyze the impacts of the closure of the existing special waste landfill and assess the construction and operation of a new on-site special waste landfill to accommodate future dry CCR disposal.

This project supports TVA's goal to eliminate all wet CCR storage across its system and will meet the requirements of the U.S. Environmental Protection Agency's CCR Rule and state permitting requirements.

Comments on the scope of this EIS must be received no later than Dec. 1, 2016. They may be submitted online at tva.gov/nepa, mailed or emailed to the address below. All comments received, including names and addresses, will become part of the project administrative record and will be available for public inspection.

Ashley Pilakowski
NEPA Compliance Specialist
Tennessee Valley Authority
400 West Summit Hill Dr., WT 11D
Knoxville, TN 37902
aapilakowski@tva.gov

Pub: West Kentucky News
Size: 4.75" x 7"
Insert: 11/4

Client: TVA
Job No: TVA4-55824
Title: Shawnee Fossil Ash Pond

TVA MEDIA ADVISORY

Public Comments Sought for Environmental Impact Statement at Shawnee Plant

PADUCAH, Ky. – The Tennessee Valley Authority is beginning an environmental impact statement on the Shawnee Fossil Plant coal combustion residuals management projects. TVA is seeking public comment until Dec. 1, 2016, on the scope of the EIS for the plant, which is located about 12 miles northeast of Paducah in McCracken County, Ky.

TVA will evaluate the closure alternatives for the existing CCR Ash Pond 2, analyze the impacts of the closure of the existing special waste landfill and analyze the construction and operation of a new on-site CCR landfill.

A portion of this EIS will tier from TVA's 2016 Programmatic Environmental Impact Statement that analyzed methods for closing CCR impoundments at TVA fossil plants and identified specific screening and evaluation factors to help frame its assessment of closures at additional facilities.

This project supports TVA's goal to eliminate wet CCR storage across its system and will meet the requirements of the U.S. Environmental Protection Agency's Disposal of Coal Combustion Residuals from Electric Utilities rule and state permit requirements.

A public open house is scheduled from 4:30-6:30 p.m. CST on Tuesday, Nov. 15, 2016, at Robert Cherry Civic Center, 2701 Park Ave., Paducah, Kentucky. Members of the public will be able to speak one-on-one with TVA experts.

Comments regarding the scope of this EIS must be received no later than Dec. 1, 2016. They may be submitted online at http://www.tva.gov/nepa, mailed to Ashley Pilakowski, 400 West Summit Hill Dr., WT 11D, Knoxville, Tennessee 37902 or e-mailed to aapilakowski@tva.gov. All comments received, including names and addresses, will become part of the project administrative record and will be available for public inspection.

For more information about TVA and its 83-year mission of service to the Tennessee Valley, click here.

# # #

Media Contact: TVA Public Relations, Knoxville, 865-632-6000
www.tva.com/news
Follow TVA news on Facebook, Twitter and Instagram

(Distributed: Nov. 2, 2016)

Appendix C: Public and Agency Comments

This page intentionally left blank

MATTHEW G. BEVIN
GOVERNOR

DEPARTMENT FOR LOCAL GOVERNMENT
OFFICE OF THE GOVERNOR
1024 CAPITAL CENTER DRIVE, SUITE 340
FRANKFORT, KENTUCKY 40601-8204
PHONE (502) 573-2382 FAX (502) 573-2939
TOLL FREE (800) 346-5606/ TDD:711
WWW.kydlgweb.ky.gov

SANDRA K. DUNAHOO
COMMISSIONER

November 29, 2016

Ms. Ashley Pilakowski
Tennessee Valley Authority
400 W Summit Hill Drive
Knoxville, TN 37902

RE: TVA Notice of Intent to Prepare an Enivornmental Impact Statement for Shawnee Fossil Plant Coal Combustion Residual Management
SAI# KY20161027-1349

Dear Ms. Pilakowski:

The Kentucky State e-Clearinghouse is the official designated Single Point of Contact (SPOC) for the Commonwealth pursuant to Presidential Executive Order 12372, and supported by Kentucky Statutes KRS 45.03. The primary function of the SPOC is to streamline the review aforementioned process for the applicant and the funding agency. This process helps in vocalizing the statutory and regulatory requirements. Information in the form of comments, if any, will be attached to this correspondence.

This proposal has been reviewed by the appropriate state agencies in the e-Clearinghouse for conflicts with state or local plans, goals and objectives. After receiving this letter you should make it available to the funding agency and continue with the funding agencies application process. This e-clearinghouse SPOC letter signifies only that the project has followed the state reviewing requirements, and is neither a commitment of funds from this agency or any other state or federal agency. Please remember if any federal reviews are required the applicant must follow through with those federal agencies.

The results of this review are valid for one year from the date of this letter. If the project is not submitted to the funding agency or not approved within one year after the completion of this review, the applicant can request an extension by email to Lee.Nalley@ky.gov. If the project changes in any way after the review, the applicant must reapply through the eclearinghouse for a new review. There are no exceptions.

If you have any questions regarding this letter or the review process please contact the e-Clearinghouse office at 502-573-2382, ext. 274.

Sincerely,

Lee Nalley

Lee Nalley, SPOC
Kentucky State Clearinghouse

Attachment

KY Heritage Council/State Historical Preservation Office (SHPO)

To receive a review from the KY Heritage Council/State Historical Preservation Office (SHPO) you must follow the instructions located on their website at http://www.heritage.ky.gov/siteprotect/ . There you will find the required documents for the Section 106 Review and Compliance for 36 CFR Part 800. This Section 106 submission process to SHPO will assist applicants and agencies in providing the appropriate level of information to receive comments from SHPO. 48

If you have any questions please contact Yvonne Sherrick, Administrative Specialist III, (502) 564-7005, Ext. 113, yvonne.sherrick@ky.gov

The KY Dept. of Transportation has made the following advisory comment pertaining to State Application Identifier Number KY201610271349

Herring (D-1), Jessica: The Kentucky Transportation Cabinet is responsible for controlling both public and private usage of right-of-way of the State road system. Any firm, individual, or government agency desiring access to a State road or desiring to perform any type of work (including signage, boring, etc.) on or adjacent to State right-of-way must obtain a permit from the Department 44

Any proposed access or encroachment of a State maintained road right-of- way should be coordinated at the earliest stage with:

Tom Hines, P.E.
Permits Engineer
Kentucky Department of Highways, District 1
5501 Kentucky Dam Road
Paducah, Kentucky 42003
Telephone: (270) 898-2431 or 1 (800) 338-4283
Fax: (270) 898-7457

Endorsed by:
Jessica Herring, EIT
Planning Section Supervisor
Kentucky Department of Highways, District 1
5501 Kentucky Dam Road
Paducah, Kentucky 42003
Telephone: (270) 898-2431 or 1 (800) 338-4283
Fax: (270) 898-7457

The Natural Resources has made the following advisory comment pertaining to State Application Identifier Number KY201610271349

This review is based upon the information that was provided by the applicant through the Clearinghouse for this project. An endorsement of this project does not satisfy, or imply, the acceptance or issuance of any permits, certifications, or approvals that may be required from this agency under Kentucky Revised Statutes or Kentucky Administrative Regulations. Such endorsement means this agency has found no major concerns from the review of the proposed project as presented other than those stated as conditions or comments. 49

The Housing, Building, Construction has made the following advisory comment pertaining to State Application Identifier Number KY201610271349 50
No comments

The KY State Fish & Wildlife has made the following advisory comment pertaining to State Application Identifier Number KY201610271349

50

Based on the information provided, the Kentucky Department of Fish & Wildlife Resources has no comments concerning the proposed project. Please contact Dan Stoelb @ 502-564-7109 ex. 4453 or Daniel.Stoelb@ky.gov if you have further questions or require additional information.

The Labor Cabinet has made the following advisory comment pertaining to State Application Identifier Number KY201610271349

51

STATE PREVAILING WAGE RATES MAY APPLY TO PROJECTS EXCEEDING $250,000.00. CONTACT KY LABOR CABINET AT 502 564 3534

The Purchase ADD has made the following advisory comment pertaining to State Application Identifier Number KY201610271349 50
No comments

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
330 West Broadway, Suite 265
Frankfort, Kentucky 40601
(502) 695-0468

November 14, 2016

Ms. Ashley Pilakowski
NEPA Compliance Specialist
400 West Summit Hill Drive, WT 11D
Knoxville, Tennessee 37902-1499

Re: FWS 2017-B-0057; Tennessee Valley Authority; Notice of Intent to Prepare an Environmental Impact Statement; Shawnee Fossil Plant, Coal Combustion Residual Management; McCracken County, Kentucky

Dear Ms. Pilakowski:

Thank you for the opportunity to provide comments on the above-referenced project. Tennessee Valley Authority (TVA) has submitted a Notice of Intent to prepare an Environmental Impact Statement (EIS) to address potential environmental effects associated with ceasing operations at the special waste landfill and ash pond 2 and building a new dry coal combustion residual landfill at the Shawnee Fossil Plant. The U.S. Fish and Wildlife Service (Service) offers the following comments in accordance with the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.).

The Service would prefer project design options that minimize impacts to federally-listed species, particularly freshwater mussels. The Ohio River near the proposed project area includes records of several federally-listed mussel species and is designated critical habitat for rabbitsfoot (*Quadrula c. cylindrica*). Freshwater mussels are one of the most imperiled groups of animals in
North America. As filter feeders, mussels are sensitive to contaminants and function as 13
indicators of problems with water quality. The potential of the proposed project to impact federally listed mussel species, as a result of impacts to water quality both in the construction (e.g., run-off during construction) and operational phases (e.g., contaminants from the landfill) should be considered in the EIS.

Current species lists for the proposed project area can be obtained from the U.S. Fish and
Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) system located at: 14
https://ecos.fws.gov/ipac/. IPaC will immediately provide you with a current species list appropriate for your proposed project and an official letter on USFWS letterhead. This list will

include species currently listed as threatened or endangered, species proposed for listing, critical habitat for listed species, and bird species of conservation concern.

When you open the IPaC site, you will be asked to input a location for your proposed project. The location can be input in different ways. Often, the easiest way is to zoom into the vicinity of the project area on the map and use the sketch tool to approximate the boundaries of the proposed project site, plus an appropriate buffer. This location that you input should represent the entire "action area" of your proposed project by considering all the potential "effects of the action," including potential direct, indirect, and cumulative effects to federally-listed species or their critical habitat as defined in 50 CFR 402.02. This includes effects of any "interrelated actions" that are part of a larger action and depend on the larger action for their justification and "interdependent actions" that have no independent utility apart from the action under consideration (e.g.; utilities, access roads, etc.) and future actions that are reasonably certain to occur as a result of the proposed project (e.g.; development in response to a new road).

IPaC will generate a species list specific to the action area of the proposed project, as you defined it. You can then request an official species list under the "Regulatory Documents" tab. This species list fulfills the requirements of the USFWS under section 7(c) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) to provide information as to whether any proposed or listed species may be present in the area of a proposed action. The letter generated by IPaC will explain how to request an updated list or a revised list based on project modifications.

Thank you for your request. Your concern for the protection of endangered and threatened species is greatly appreciated. If you have any questions or problems obtaining a species list from IPaC, please contact Jessica Blackwood Miller at (502) 695-0468 extension 104 or jessica_miller@fws.gov.

Sincerely,

Virgil Lee Andrews, Jr.

Virgil Lee Andrews, Jr.
Field Supervisor

1.866.522.SACE
www.cleanenergy.org

P.O. Box 1842
Knoxville, TN 37901
865.637.6055

46 Orchard Street
Asheville, NC 28801
828.254.6776

250 Arizona Avenue, NE
Atlanta, GA 30307
404.373.5832

P.O. Box 310
Indian Rocks Beach, FL 33785
954.295.5714

P.O. Box 13673
Charleston, SC 29422
843.225.2371

Ashley Pilakowski
Tennessee Valley Authority
aapilakowski@tva.gov

Via Electronic Mail

December 1, 2016

Re: Scoping Comments on TVA's Environmental Impact Statement on the Shawnee Fossil Plant Coal Combustion Residuals Management Project

Dear Ms. Pilakowski,

The Southern Alliance for Clean Energy, Environmental Integrity Project, Earthjustice and Sierra Club submit the following comments for the scope of the Tennessee Valley Authority's (TVA) Environmental Impact Statement (EIS) on the Shawnee Fossil (SHF) Plant Coal Combustion Residuals Management Project. We appreciate the opportunity to weigh in prior to the formation of the EIS. We understand that the EIS for SHF will "tier from" TVA's programmatic Environmental Impact Statement (EIS) for closing Coal Combustion Residual (CCR) impoundments at TVA fossil plants. Our comments likewise tier from comments that some of us provided on that process. Specifically, we are attaching scoping comments (September 30, 2015), and three sets of comments on the draft programmatic EIS and the final programmatic EIS.

I. Comments on the Legal Requirements for Scope of Analysis Required in EIS

The National Environmental Policy Act ("NEPA") is "our basic national charter for protection of the environment."[1] Other environmental statutes focus on particular media (like air, water or land), specific natural resources (such as wilderness areas, or endangered plants and animals), or discrete activities (such as mining, introducing new chemicals, or generating, handling or

[1] 40 C.F.R. § 1500.1(a).

disposing of hazardous substances). In contrast, NEPA applies broadly "to promote efforts which will prevent or eliminate damage to the environment."[2] "[NEPA] has 'twin aims. First, it places upon [a federal] agency the obligation to consider every significant aspect of the environmental impact of a proposed action. Second, it ensures that the agency will inform the public that it has indeed considered environmental concerns in its decision-making process.'"[3]

A. Purpose and Need

NEPA requires TVA to "briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action."[4] TVA "cannot define a project's purpose and need so narrowly that it contravenes NEPA's mandate to evaluate reasonable alternatives."[5]

The Scoping Notice appears to identify two purposes for the EIS – "to foster TVA's compliance with present and future regulatory requirements related to CCR production and management, including the requirements of EPA's CCR Rule and Effluent Limitations Guidelines Rule." Thus, the purpose of the EIS is to analyze proposed alternatives for construction and closure activities that would facilitate compliance under two very different regulation regimes, solid waste storage and water discharges, respectively. TVA's statement of purpose establishes additional storage and ash management activities as a foregone conclusion and precludes the consideration of reasonable alternatives, including cessation of coal-fired generation at SHF. It is unclear whether TVA will – as it must – consider closure of Ash Pond 2 by removing the CCRs currently stored there. 2 5

To achieve NEPA's purposes of full disclosure and consideration of environmental impacts associated with the proposed action and alternatives, the underlying purpose and need must not be defined so narrowly. TVA must re-characterize the purpose and need and explore separating the analysis of closure of existing ash storage facilities at SHF in order to properly and 4

[2] NEPA § 2, 42 U.S.C. § 4321.
[3] *Kern v. Bureau of Land Management*, 284 F.3d 1062, 1066 (9th Cir. 2002) (quoting *Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, Inc.*, 462 U.S. 87, 97 (1983)) (internal quotations and citations omitted, alteration in original).
[4] 40 C.F.R. § 1502.13.
[5] *Coal. for Advancement of Reg'l Transp. v. Fed. Highway Admin*., 576 F. App'x 477, 487 (6th Cir. 2014) (quoting *Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 196 (D.C.Cir.1991)).

adequately evaluate a reasonable range of alternatives in the EIS for both of these very different activities. 4

B. Alternatives

The alternatives analysis is "the heart of the environmental impact statement."[6] In evaluating alternatives, TVA is required to "[r]igorously explore and objectively evaluate all reasonable alternatives."[7] "Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant."[8] The discussion in the EIS must "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."[9] The EIS must include consideration of a "no-action" alternative as well as other reasonable alternatives.[10]

In the Scoping Notice, TVA gives very little information regarding the alternatives related to the closure of existing ash storage facilities that it plans to consider in the EIS, stating, "TVA will evaluate the potential environmental impacts of closure of the special waste landfill and Ash Pond 2." TVA goes on to state it will evaluate the impacts of the aforementioned closure of the special waste landfill and Ash Pond 2 as well as "construction, operation, and maintenance of an onsite dry CCR landfill or disposal of CCR in an existing offsite permitted landfill."[11] About various options for closure of the Ash Pond and the special waste landfill, TVA simply states that it will "consider closure alternatives … in accordance with TVA's PEIS and EPA's CCR rule." These options must include closure by removal of CCRs, one of the two options outlined in the CCR rule.[12] 5

[6] 40 C.F.R. § 1502.14.
[7] 40 C.F.R. § 1502.14.
[8] Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18026-01 (March 23, 1981).
[9] 40 C.F.R. § 1502.14.
[10] *Id.; id.* § 1508.25.
[11] 81 Fed. Reg. 75897
[12] 40 CFR § 257.102.

In addition, TVA states it "will develop and evaluate various alternatives, including the No Action Alternative, in the EIS."[13] The "no-action" alternative should evaluate the impacts of an agency's choice *not* to take action, including the impacts of predictable actions by others based on the agency's decision not to act.[14] It is not clear from the description of the no-action alternative in the Scoping Notice how TVA plans to analyze the environmental consequences associated with continuing to dispose of CCR in disposal areas that are likely to trigger corrective action under federal law. One predictable consequence of that choice would be enforcement by the State of Kentucky or citizens, which could ultimately lead to temporary or permanent cessation of coal-fired generation at SHF. Thus, in evaluating the no-action alternative, TVA must take into account the impacts of temporary or permanent cessation of coal-fired generation at SHF. 4

Similarly, TVA must consider retirement of SHF as a reasonable alternative to the proposed action. As noted above, TVA cannot dismiss an alternative simply because it is not "desirable" from TVA's standpoint. Although the Scoping Notice makes the conclusory assumption that SHF will continue operation into the foreseeable future, it offers no explanation of why retirement of the coal-fired units at SHF would be technically or economically infeasible. Over the past few years, TVA has announced retirements of all units at Allen, Colbert, Johnsonville, Widows Creek and John Sevier, as well as some units at Paradise and SHF Unit 10.[15] 3

As TVA recognizes in its draft 2015 IRP, coal generation is increasingly uneconomic, and changing environmental standards for carbon emissions will drive retirement decisions within the next ten years.[16] Given the regulatory uncertainty and economic vulnerability associated with coal-fired generation, TVA must consider retirement of the coal-fired units at SHF as a reasonable alternative to additional storage capacity for CCRs in its EIS. 2

[13] Id.
[14] Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18026-01 (March 23, 1981).
[15] TVA, Draft 2015 Integrated Resource Plan 40 (March 2015).
[16] TVA, Draft 2015 Integrated Resource Plan 91 (March 2015).

C. Cumulative Impacts

In addition to examining a reasonable range of alternatives, NEPA also requires TVA to identify connected and cumulative actions and to analyze the cumulative impacts of its proposed action in relation to those actions.[17] Actions are connected if they are "interdependent parts of a larger action and depend on the larger action for their justification."[18] A cumulative action is an action that "when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement."[19] Cumulative impacts are "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."[20] These impacts "can result from individually minor but collectively significant actions taking place over a period of time."[21]

Among the concerns TVA is required to consider is the Project's impact on climate change.[22] And, as both the Supreme Court and the Council on Environmental Quality have recognized, because climate change is necessarily a global problem, it can only be addressed incrementally by reducing or eliminating emissions from many individual relatively small sources.[23] SHF is one such source.

The Scoping Notice does not identify any connected or cumulative actions that will be analyzed in the EIS. Nor does it identify any cumulative impacts. Based upon the limited information in the Scoping Notice, connected and cumulative actions, and the cumulative impacts associated with them, that must be analyzed in the EIS, include, but are not limited to: 11

- Coal mining, including any coal sourced from mines that engage in mountain-top removal;

[17] 40 C.F.R. §1508.25.
[18] *Id.*
[19] *Id.*
[20] 40 C.F.R. § 1508.7.
[21] *Id.*
[22] *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*, August 1, 2016, available at https://www.whitehouse.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf
[23] *Massachusetts v. EPA*, 549 U.S.497, 524 (2007); Draft Climate Change Guidance at 9 ("Government action occurs incrementally, program-by-program and step-by-step, and climate impacts are not attributable to any single action, but are exacerbated by a series of smaller decisions, including decisions made by government.").

- Transportation of coal to SHF;
- Coal combustion, including impacts from common air pollutants and carbon pollutants;
- Dewatering, including water quality impacts; 11
- Storage, including water quality impacts from existing coal ash ponds and fugitive dust from existing dry storage;
- Impact on wildlife and endangered species.

In addition, to the extent that TVA intends to use the proposed action as a model for storage of
CCRs at its other coal-fired plants, the cumulative impacts associated with replicating the 12
proposed action across its fleet, including the above-mentioned cumulative impacts, should be analyzed in the EIS.[24]

II. Comments on Specific Environmental Impacts Required to be Included in EIS

As laid out in TVA's notice, we agree that the following environmental impacts analysis must be included in the EIS:

- Water resources (surface water, groundwater quality, and use);
- Vegetation;
- Wildlife;
- Aquatic ecology;
- Endangered and threatened species; 7
- Floodplains and wetlands;
- Geology;
- Land use;
- Transportation;
- Recreational and managed areas;
- Visual resources;
- Archaeological and historic resources;
- Solid and hazardous waste;
- Public health and safety;

[24] 40 C.F.R. § 1508.25.

- Noise;
- Air quality and climate change; 7
- Socioeconomics and environmental justice

As TVA notes in the request for comments, the TVA Board of Directors decided to phase out wet handling and storage of fly ash six years ago. We strongly support that decision and remain 47 hopeful that TVA will accomplish the goal as soon as possible. It is unfortunate, however, that as TVA works to convert its coal fleet to dry handling it has systematically failed to admit the legacy of contaminated groundwater across all of its coal facilities. Existing coal ash disposal 16 also presents risks to human health and the environment through air, soil, surface water, and sediment exposure pathways. TVA must evaluate the risks that these exposure pathways pose currently, and must also evaluate the extent of the risks associated with new disposal areas.

Currently, the groundwater beneath SHF site is contaminated, and the contamination is directly attributable to decades of unsafe coal ash disposal at the site. This EIS represents an important opportunity for TVA to change course on this issue and address its legacy contamination. The options that TVA is considering for dry ash handling touch on all existing ash disposal areas, 37 therefore the EIS must fully evaluate the environmental impacts of coal ash site-wide:

- If TVA opts for a new coal ash landfill, then it will have to close some or all of the existing ash disposal areas, and how TVA chooses to close them will have important environmental consequences. In addition, a new landfill will have to conform to the requirements of EPA's new Resource Conservation and Recovery Act ("RCRA") Subtitle 38 D rule for coal ash (see detailed comments on that point below).

- TVA is also considering "hauling [coal ash] to an existing permitted landfill." If that landfill is the existing, on-site coal ash landfill, TVA should directly address the ongoing groundwater contamination at that landfill (see below), explain how it happened, and 17 explain in detail how they will prevent it from happening in an expansion (which would also be regulated as a new landfill under the EPA RCRA rule).

- Finally, TVA must describe in sufficient detail the affected environment or "baseline" conditions and the "No Action" alternative. Answering the question "Is an offsite landfill better than ongoing, onsite ash disposal, from an environmental perspective?" requires an accurate characterization of the current baseline in the description of the affected 8 environment and of future conditions under the No Action alternative. The public must be informed about the extent of contamination at SHF under the baseline condition in order to form educated opinions about environmental impacts of the alternatives. And if TVA were to adopt the "No Action" alternative, it would be perpetuating site-wide 15 groundwater contamination by continuing to add coal ash to disposal areas that are known to be leaking, at least until enforcement required coal-fired generation to cease.

As an overarching matter, TVA must take responsibility for existing contamination. In the past, TVA has attempted to evade the issue. TVA has asserted that the level of current groundwater contamination is not in violation of groundwater quality standards (which ignores high levels of pollutants, like boron, that do not currently have standards), or has tried to argue that contamination is naturally occurring.

For SHF, TVA has at times been more forthcoming, as described in the following section. In the EIS, TVA should provide an honest assessment of all of the information that it has on hand regarding the extent of coal ash-related groundwater contamination at SHF.[25] An example of the straightforward language the public will expect to see in the EIS exists in the February 2014 groundwater monitoring report for SHF, where TVA admitted that "statistical findings indicate coal-combustion by-product effects on groundwater beneath and downgradient of the 18 special waste landfill" based on high concentrations of boron, molybdenum, sulfate, and other pollutants.[26]

As described in more detail below, it is indisputable that the coal ash disposal areas at SHF have contaminated the groundwater beneath the plant. Under the requirements of RCRA, TVA will eventually have to close these disposal units and/or take corrective action. For the EIS process to

---

[25] In order to provide this assessment, TVA should not discontinue monitoring for coal ash indicator pollutants in wells that have previously shown high levels of these pollutants.

[26] TVA, letter to Deborah DeLong, Kentucky Division of Waste Management, transmitting February 2014 quarterly groundwater report for Shawnee Fossil Plant Special Waste Landfill (Apr. 25, 2014)

have any legitimacy, TVA must be more transparent about the extent, cause, and remedial implications of the contamination. 18

III. Groundwater Quality

The disposal of coal ash at SHF has caused widespread and severe groundwater contamination. This is likely to continue if the ash is left in place after closure, particularly if any ash is left below the water table. As TVA knows, groundwater monitoring shows elevated concentration of many coal ash-related pollutants. TVA said as much in 2014: 19

> Statistical exceedances were determined for: boron, molybdenum, pH, specific conductance, sulfate, vanadium, and total dissolved solids from the sampling. The exceedances were reported to KDWM via email on April 8, 2014. No confirmation sampling was performed following the monitoring event because statistical exceptions were similar to those previously observed . . . **[S]tatistical findings indicate coal-combustion by-product effects on groundwater beneath and downgradient of the Special Waste landfill.**[27] (emphasis added)

More recently, TVA noted that there were "statistical exceedances for boron, calcium, chemical oxygen demand, total organic carbon, cobalt, iron, magnesium, manganese, molybdenum, nickel, pH, potassium, specific conductance, strontium, sulfate, and total dissolved solids," and stated that "some of the metals that have statistical exceedances could be attributed to CCRs [Coal Combustion Residuals]."[28]

In fact, the groundwater contamination at SHF is severe and is undeniably caused by leachate from the coal ash disposal units.[29] The majority of downgradient wells at SHF show unsafe levels of boron and manganese, both toxic pollutants known to be associated with coal ash. Boron concentrations are as high as 25 mg/L, eight times above the EPA health advisory of 3 mg/L, and manganese concentrations are as high as 69 mg/L, 200 times above the health advisory of 0.3 mg/L. Other coal ash pollutants present at unsafe levels in groundwater near the SHF ash disposal areas include aluminum, arsenic, cobalt, molybdenum, and sulfate.

---

[27] TVA, letter to Deborah DeLong, Kentucky Division of Waste Management, transmitting February 2014 quarterly groundwater report for Shawnee Fossil Plant Special Waste Landfill (Apr. 25, 2014) (emphasis added).
[28] TVA, Final Environmental Assessment for the Shawnee Fossil Plant Bottom Ash Process Dewatering Facility (Sep. 2016).
[29] *See generally*, Environmental Integrity Project, *TVA's Toxic Legacy: Groundwater Contaminated by Tennessee Valley Authority Coal Ash* (Nov. 2013).

Comparisons between up- and downgradient wells show an unmistakable pattern of contamination emanating from SHF's ash disposal area (see Tables 1 through 3, below).

It may be the case that no one is currently using the contaminated aquifers as potable water supplies, but if TVA leaves ash buried beneath the water table, the aquifers will be unsafe for 19
human use for thousands of years. EPA estimates that peak offsite concentrations of coal ash contaminants from unlined landfills occur from 74 years (for some pollutants, like boron) to over 6,000 years (for arsenic V) after impoundments are first years.[30] For landfills, peak concentrations occur after thousands of years for all pollutants.[31]

TVA must therefore assess the degree to which coal ash is and will be saturated with groundwater. We know that SHF's coal ash disposal area contains ash to a depth (elevation) of 310 feet.[32] A 2010 engineering report provided Ohio River and onsite piezometer readings for February-May 2010, which showed that the Ohio River rose to an elevation of 321 feet (11 feet higher than the bottom of the ash pond), and that local groundwater within the pond and the dry 20
stack areas was as high as 330 feet.[33] Groundwater levels in the monitoring wells surrounding the disposal area show groundwater as high as 324 feet.[34] In short, it appears that a significant portion of the coal ash at SHF is beneath the water table, saturated, and constantly leaching pollutants into local groundwater and surface water.

[30] U.S. EPA, Human and Ecological Risk Assessment of Coal Combustion Residuals, 5-36 (Dec. 2014).
[31] Id, at 5-37.
[32] Stantec Consulting Services, Inc., Report of Geotechnical Exploration and Slope Stability Evaluation – Ash Pond 1 & 2 and Consolidated Waste Dry Stack – Shawnee Fossil Plant, Appendices A and G (July 14, 2010).
[33] Id. at Appendix B.
[34] See, e.g., TVA, Groundwater and Surface Water Monitoring Sample Data Reporting Form for Shawnee Fossil Plant, 2nd quarter 2011.

Table 1: Boron concentrations in SHF monitoring wells, 2008-2015; upgradient data are in blue, downgradient data are in black.[35]

Aquifer	Well	Mean (ug/L)	Range (ug/L)	N
Alluvium	*D-77 (upgradient)*	*143*	*<50 – 410*	*20*
	D-11	93	<50 – 220	16
	D-33A	2,380	1,910 – 2,600	16
	D-30A	5,091	990 – 12,000	18
	D-74A	5,613	2,000 – 10,000	18
Upper Consolidated Deposits (UCD)	*D-19 (upgradient)*	*71*	*<50 – <200*	*19*
	D-75A	7,485	6,800 – 8,300	17
	D-76A	20,740	15,000 – 25,200	15
Regional Groundwater Aquifer (RGA)	*D-27 (upgradient)*	*24*	*13.5 – <50*	*19*
	D-8A	163	<200 – 265	18
	D-11B	2,329	1,400 – 2,800	16
	D-30B	4,546	500 – 6,600	18
	D-74B	7,720	5,100 – 11,000	18
	D-75B	5,980	3,190 – 8,200	17

Table 2: Sulfate concentrations in SHF monitoring wells, 2008-2015; upgradient data are in blue, downgradient data are in black.[36]

Aquifer	Well	Mean (mg/L)	Range (mg/L)	N
Alluvium	*D-77 (upgradient)*	*73*	*32 – 226*	*20*
	D-11	35	31 – 42	16
	D-33A	61	54 – 69	16
	D-30A	252	83 – 500	18
	D-74A	118	20 – 320	18
UCD	*D-19 (upgradient)*	*141*	*110 – 200*	*19*
	D-75A	1,052	882 – 1,400	17
	D-76A	1,157	875 – 1,500	16
Upper RGA	*D-27 (upgradient)*	*39*	*34 – 47*	*19*
	D-8A	13	11 – 15	18
	D-11B	224	130 – 280	16
	D-30B	190	57 – 410	18
	D-74B	191	100 – 340	18
	D-75B	438	201 – 560	17

[35] Data obtained by the Environmental Integrity Project from TVA through multiple information requests. For purposes of averaging data, nondetects were treated as being present at one half of the detection limit. Some data from June 2013 appeared to be transcription errors and were excluded specifically, we excluded a value of 22 mg/L for well D77, which otherwise never exceeded 0.41 mg/L, and a value of 6.4 mg/L for well D76A, which was otherwise never lower than 15 mg/L).
[36] Data obtained by the Environmental Integrity Project from TVA through multiple information requests.

Table 3: Manganese concentrations in SHFmonitoring wells, 2010-2015 (monitoring reports for 2008-2009 did not include manganese); upgradient data are in blue, downgradient data are in black.[37]

Aquifer	Well	Mean (mg/L)	Range (mg/L)	N
Alluvium	*D-77 (upgradient)*	*0.7*	*0.01 – 3.7*	*12*
	D-11	0.3	0.1 – 0.6	11
	D-33A	0.9	0.8 – 1.0	11
	D-30A	4.8	0.2 – 10.0	13
	D-74A	0.6	0.3 – 1.2	13
UCD	*D-19 (upgradient)*	*0.02*	*0.01 – 0.04*	
	D-75A	65.4	60.2 – 69.0	12
	D-76A	4.7	3.4 – 5.9	11
Upper RGA	*D-27 (upgradient)*	*0.004*	*0.001 – 0.01*	*11*
	D-8A	1.8	1.1 – 2.1	13
	D-11B	3.9	1.4 – 5.9	11
	D-30B	4.6	3.1 – 5.8	13
	D-74B	1.2	0.9 – 1.8	13
	D-75B	10.1	3.7 – 65.0	12

According to TVA, the Electric Power Research Institute (EPRI) has modeled the groundwater concentrations of coal ash pollutants for a scenario where a hypothetical surface impoundment is closed in place.[38] The EPRI model estimates, for the closure-in-place scenario where coal ash is in contact with groundwater ("Intersecting GW"), that groundwater concentrations will plateau at roughly 40% of the "concentration in leachate," and never drop below that concentration for at least 140 years. Much of the contamination shown above, even if reduced by 60%, would continue to exceed human health benchmarks under this scenario. TVA must therefore assess the 21
risks to future inhabitants of the area who may wish to use the groundwater.

IV. Federal Legal Requirements for Coal Ash Disposal.

In April 2015, EPA promulgated a coal ash disposal regulation under RCRA.[39] The regulation
imposes a number of important requirements on TVA, requirements that affect both current and 22
future coal ash disposal and storage. These include, but are not limited to, the following:

[37] Data obtained by the Environmental Integrity Project from TVA through multiple information requests.
[38] TVA, Final Ash Impoundment Closure EIS Part I, at App. B, Regional Energy Resource Council Presentation at 44 (June 2016).
[39] US EPA, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule, 80 FR 21302 (Apr. 17, 2015); 40 CFR 257.

- Existing coal ash ponds, and all new coal ash disposal areas, must be built at least five feet above the uppermost groundwater aquifer. As described above, the SHF fly ash impoundment, which is partially buried beneath the water table, fails this requirement and therefore must be closed per RCRA regulations. TVA must also demonstrate that any new coal ash landfill is at least five feet above local groundwater. 22

- New coal ash disposal areas cannot be built in wetlands, fault areas, or seismic impact zones. 40

- New coal ash disposal areas cannot be built in geologically unstable areas, such as areas with karst bedrock.

- New coal ash landfills must have composite liners and leachate collection systems. 23

- TVA (and other owners and operators) must prepare and follow fugitive dust control plans for all coal ash disposal areas. 41

- TVA must design and maintain run-on and run-off control systems for all coal ash landfills. 24

- TVA must monitor the groundwater around all active coal ash disposal areas for boron, calcium, chloride, fluoride, pH, sulfate, and Total Dissolved Solids (TDS).

- If downgradient groundwater wells show any of the above-listed monitoring parameters at concentrations that exceed background, TVA must also monitor for antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226/228; these are collectively defined as "assessment monitoring" constituents in the rule. 25

- Existing, unlined surface impoundments must be closed if they cause assessment monitoring constituents to exceed the groundwater standards prescribed by the rule. 26

- For all landfills that cause assessment monitoring exceedances, TVA must undertake corrective measures "to prevent further releases, to remediate any releases and to restore affected areas to original conditions."[40] 27

- The rule also provides requirements for how TVA must close its coal ash disposal areas, including requirements for post-closure care. 28

V. Other Environmental Impacts of Coal Ash Disposal

Coal ash disposal presents risks to human health and the environment through multiple exposure pathways. The groundwater risks at SHF are clear from the evidence described above. Other pathways have not been examined at SHF specifically, but are likely to be present. The potential risks from these other pathways are laid out in the risk assessment for the RCRA coal ash rule.[41]

a. Air Quality

Coal ash that becomes airborne can present inhalation risks to human health. The risk assessment predicted significant risks from arsenic and fine particulate matter, or PM2.5, at landfills that are not adequately controlled.[42]

Airborne coal ash eventually settles, and after it settles it can present risks to human health or the environment through soil exposure or through the food chain. The risk assessment stated that "[u]nder the uncontrolled management scenario, thallium was found to pose human health risks for multiple pathways [exposure to contaminated soil, milk, and beef], while multiple constituents were found to pose ecological risks for soil and sediment."[43] The contaminants posing ecological risks include antimony, arsenic, boron, selenium, silver, and vanadium.[44]

b. Surface Water and Sediment Quality

As contaminated groundwater migrates into surface water, the surface water and sediment become contaminated. The risk assessment found significant risks to ecological receptors from surface water contaminated in this way. Specifically, under certain conditions boron and

---

[40] 40 CFR 257.96(a).
[41] U.S. EPA, Human and Ecological Risk Assessment of Coal Combustion Residuals (Dec. 2014).
[42] *Id*. at 3-7, 3-24. EPA did not model this pathway in its full probabilistic model.
[43] *Id*. at 3-16, 3-24. Again, EPA did not model these pathways in its full probabilistic model.
[44] *Id*.

cadmium both present significant risks.[45] TVA already has data showing elevated concentrations of boron in Little Bayou Creek. Specifically, in 2012, at a sampling location immediately downstream of the ash disposal area, TVA found boron concentrations of 710-860 micrograms per liter (µg/L); boron in all upstream sampling locations was below detection (<200 µg/L).[46] In 29
other words, TVA already knows that a pollutant of ecological concern – boron – is leaching into Little Bayou Creek. TVA must therefore evaluate the future risk to surface water and sediment from boron and other coal ash-related pollutants under each scenario and each closure option. At a minimum, TVA must evaluate the risks associated with EPA's pollutants of concern for ecological receptors – boron and cadmium.

TVA must also evaluate the risks presented by manganese leachate, for the following reasons. First, EPA has identified manganese as a coal ash pollutant.[47] Second, there is a clear difference in concentration between upgradient and downgradient wells, indicating that the coal ash disposal areas are responsible. Table 3, above, summarizes the manganese data for the site. 30
Third, with concentrations orders of magnitude above the EPA Lifetime Health Advisory for manganese, the affected groundwater is hazardous to human health. It may also be hazardous to aquatic life as it leaches in Little Bayou Creek and the Ohio River: EPA has noted that "biota with elevated levels [of manganese] have exhibited sublethal effects including metabolic changes and abnormalities of the liver and kidneys."[48]

It is very likely that boron, cadmium, and manganese (and potentially other pollutants as well)
currently present risks to the local ecosystem and will continue to do so if the ash disposal area is 31
closed in place. These are threats that TVA cannot ignore.

[45] *Id.* at 5-8.
[46] TVA, *Groundwater and Surface Water Sample Data Reporting Form, Shawnee Fossil Plant*, 1st half 2012 (July 31, 2012).
[47] U.S. EPA, *Steam Electric Power Generating Point Source Category: Final Detailed Study Report*, 6-3 (Oct. 2009).
[48] *Id*. Although TVA monitors surface water along Little Bayou Creek, it does not measure manganese. TVA, *Groundwater and Surface Water Sample Data Reporting Form, Shawnee Fossil Plant*, 1st half 2012 (July 31, 2012).

c. Climate Change

According to newly released EPA Counsel on Environmental Quality guidelines related to consideration of greenhouse gas emissions and the effects of climate change in NEPA reviews, TVA should consider the effects of increased extreme weather events on decisions made regarding both closure of SHF ash storage facilities as well as the construction of future dry ash 42
storage faculties on site.[49] To the extent TVA plans to leave SHF ash in place as a closure option for existing SHF storage facilities, TVA is required to consider the impacts of increased storm-related flooding as well as the risk of catastrophic waste washout or other releases of CCR to surface waters.

VI. Requirements of an Environmental Impact Analysis

At a minimum, TVA must fully characterize the existing coal ash deposits at the site and the groundwater, surface water, soil, sediment, and air contamination being caused by these deposits; model future contamination through each of the above-named exposure pathways under each 9
alternative, including the no action alternative; and explain how it intends to remediate existing contamination, as required by federal law. Specifically, TVA must do the following:

1. **Groundwater quality data**. For each disposal area, TVA must fully characterize groundwater contamination using the now well-known indicators of coal ash pollution – boron, sulfate, Total Dissolved Solid (TDS), and the other pollutants listed in Appendix III of the RCRA coal ash rule.[50] For each of these pollutants, TVA must assess upgradient and downgradient groundwater quality and identify all downgradient exceedances. Downgradient wells must be located in locations and at depths appropriate 32
for detecting likely groundwater migration pathways. Upgradient wells must be located sufficiently far away from coal ash disposal areas to be safely unaffected by coal ash. As discussed above, TVA has already generated much of this evidence, and to the extent that the data are sufficient and appropriate, TVA must use existing data in its analysis.

[49] *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*, August 1, 2016, available at https://www.whitehouse.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf.
[50] 40 CFR Part 257 Appendix III.

As discussed above, the existing database already shows widespread coal ash contamination. Therefore, TVA must also assess upgradient and downgradient groundwater quality for all of the pollutants listed in Appendix IV of the RCRA rule. 32 Again, to the extent that the data are appropriate, TVA must use existing data in its analysis.

2. **Ash Pond closure**. TVA will be required by law to close the Ash Pond because it is built below the water table. This is a connected and cumulative action, and TVA must provide a detailed plan, including a timeline, for closure of that pond in the EIS. Since the ash in this Ash Pond is saturated with groundwater, the only environmentally safe way of closing the pond is to remove all of the ash. The EIS must specifically explain how and when this will happen and identify potential permanent storage options for the ash once it is removed. 6

3. **Corrective action and closure of other coal ash disposal areas**. TVA will eventually be required to undertake corrective action at the disposal areas, due to these areas' contribution to the contamination of local groundwater. Again, this corrective action should be viewed as a connected and cumulative action, and TVA must provide a detailed plan, including a timeline, for corrective action. Since the ash in disposal areas is saturated with groundwater, the only environmentally safe way of closing these areas is to remove all of the ash. The EIS must specifically explain how and when this will happen, and how and when TVA will properly close each area. The EIS must also provide a detailed explanation of how the corrective action plan will, as required by law, "restore affected areas to original conditions."[51]

4. **Hydrologic modeling**. There is no doubt that most of the contaminated groundwater at the SHF site is migrating into Little Bayou Creek and the Ohio River through subsurface flow and through seeps. This surface water pollution presents a public health threat to any 33 downstream consumers of the water. The surface water pollution also presents an

[51] 40 CFR 257.96(a).

ecological threat.[52] TVA must provide long-term modeling of this pollution pathway in order to provide the public with a meaningful sense of how significant this pollution load is going to be over the coming decades. 33

5. **Surface water quality monitoring**. TVA must also continue to monitor surface water in Little Bayou Creek for an expanded list of pollutants, immediately upstream and downstream of the plant, using methods that are sufficiently sensitive to detect pollutants of concern. 34

6. **Sediment quality monitoring**. In addition, many of the metals that are being discharged into the two water bodies settle out into sediment, and risk assessments have demonstrated a clear risk to ecological receptors through sediment exposure.[53] Given this known exposure pathway and risk, TVA must sample the sediment along both shorelines, and compare sediment sampling results to appropriate risk-based thresholds for sediment quality.[54] 35

7. **Remediation**. To the extent that any of the above analyses show a risk to human health or ecological integrity, TVA must explain how it intends to restore the area to its original condition. 36

8. **Fugitive dust**. Several exposure pathways begin with fugitive dust. TVA must estimate these risks and explain how it will control fugitive dust under each Alternative. 43

9. **Complete environmental analysis for each alternative**. Finally, TVA must explain in detail how each of the alternatives that it evaluates will impact the baseline condition and the baseline risk, including groundwater quality and surface water quality. 10

In order to comply with the requirements of NEPA, TVA must consider the aforementioned environmental impacts analysis in its EIS.

---

[52] See, e.g., U.S. EPA, Human and Ecological Risk Assessment of Coal Combustion Residuals, Table 5-5 (Dec. 2014) (showing significant ecological risks from exposure to boron and cadmium in surface water certain types of coal ash impoundment).

[53] *See, e.g.*, *id* at Table 3-7(showing significant ecological risks from exposure to antimony, arsenic, silver, and vanadium in sediment under an "uncontrolled" coal ash disposal scenario). Note, however, that this risk assessment only looked at transport of pollutants by wind and overland runoff, and not the likely dominant pathway of subsurface transport. This risk assessment is therefore likely to be a substantial underestimate of the true ecological risk from sediment at coal plants.

[54] *See, e.g.*, *id*. at Table E-5.

Please feel free to contact us with any questions or concerns related to these comments.

Respectfully submitted,

Angela Garrone, Attorney
Southern Alliance for Clean Energy
P.O. Box 1842
Knoxville, TN 37901
phone: 901-827-3687
email: angela@cleanenergy.org

Zachary Fabish, Staff Attorney
Sierra Club Environmental Law Program
50 F St NW, Eighth Floor
Washington, DC, 20009
Phone: (202) 675-7917
email: zachary.fabish@sierraclub.org

Abel Russ, Attorney
Environmental Integrity Project
1 Thomas Circle, Suite 900
Washington, DC 20005
phone: (202) 296-8800
email: aruss@environmentalintegrity.org

Mary Whittle, Attorney
Earthjustice
Earthjustice Coal Program Office
3904 Bonnell Drive
Austin, Texas 78731
phone: (215) 717-4524
email: mwhittle@earthjustice.org

TVA

Public Scoping Comment Form

Shawnee Fossil Plant Coal Combustion Residual Management Project Environmental Impact Statement (EIS)

We want your comments! If you have any issues, concerns, or questions that you would like addressed in the Shawnee Fossil Plant Coal Combustion Residual Management Draft Environmental Impact Statement (EIS), please complete and submit this comment sheet at the scoping meeting to ensure your input is considered. You can also drop the comment sheet in the mail to the address on the reverse side of this sheet. Fold the comment sheet on the lines with the return address showing, tape it closed, affix a stamp, and mail. You may attach additional pages. Please submit your comments by ***December 1, 2016***.
You may also submit comments by e-mail to Ashley Pilakowski, aapilakowski@tva.gov.

For your comments to be the most effective, TVA suggests the following guidelines:

- Keep your comments focused on the proposed project;
- Submit your comments on potential impacts and ideas for project alternatives; and
- Submit your comments within the timeframes announced. This helps the agencies include all concerns in the Draft EIS document.

If you have no comments or questions, but would like to be on our mailing list and receive a copy of the Draft EIS, please complete the contact information below.

Seeing as how TVA doesn't want to pay Enough for our homes + property, We think they should at least have our houses + buildings cleaned on a twice yearly basis. They are SO DIRTY right now from the fly Ash in the air that we can wipe down everything every day from the accumulation in the air from TVA. 54

We are SO Disappointed in the amounts We all were offered from TVA for our properties, It was Very low ball offers!!! We didn't go to TVA to get them to buy. They Came To US!!! We owned this land before TVA was ever built + they Should Keep Our property Clean! 55

The people who were at the meeting didn't give us any answers to our Questions. They didn't know when they would dump The flyash! 45

Please provide your contact information. If you would like to receive copies of the Draft EIS, please fill in the box on the reverse side and submit this form.

Before including your address, phone number, e-mail address or any other personally identifying information in your comment, you should be aware that your entire comment – including personal identifying information - may be made publicly available at any time. While you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Name: Larry + Pam Adams Title: Owners
Organization: Land + home owners on Gipson Road
Mailing address: 9050 Gipson Road.
City, State, Zipcode: West Paducah, Ky. 42086
E-mail:
Phone: 270-488-3411

Thank you for your interest and participation!

Fold 2

Larry Adams
9050 Gipson Rd.
West Paducah, Ky. 42086

EVANSVILLE IN 476
21 NOV 2016 PM 1 L

Shawnee Fossil Plant Coal Combustion Residual Management Project
Tennessee Valley Authority
Attn: Ashley Pilakowski, NEPA Specialist
400 Summit Hill Drive, WT11D
Knoxville. TN 37902-1499

37902-141999

Fold 1

Shawnee Fossil Plant Coal Combustion Residual Project mailing list
To have your name added or removed from our mailing list for this project, please check the appropriate box. Be sure to fill out the contact information on the reverse side. If you do not ask us to remove your name from our mailing list, we will send you future EIS-related announcements.

☑ Yes, add my name to the mailing list to receive future information

☐ No, please remove my name from the mailing list

Sign up to receive Draft EIS notification

☐ Please notify me when the Draft EIS becomes available.

The Draft EIS will be available for download on TVA's website at http://www.tva.gov/nepa

November 28, 2016

Ashley Pilakowski,

The next time TVA puts on informational meeting about SHF Plant. Send 7 people that can 45
explain the maps and answer our questions.

June 2016 on SHF Plant website is an 88 page report. You could have handled out information 46
on November 15, 2016. That would explain the process of the CCR. But no, TVA does not want
people to know in the future you will be polluting the land, and water causing harm to the
health of families that live nearby, and along with all the wild life. There are approximately 57
homes in the one to two mile area east and southeast of SHF Plant that will be affected by the 39
future waste material and exposed to all the fly ash dust. This will be a health hazard to all of
us. Right now fly ash is stock piled on SHF plant land. But when the Bag house by passes due to
lose of air pressure or strong winds from west and north, it blows all fly ash over to our land,
homes and cars. I have pictures of fly ash in the air coming from east stack at Shawnee back on
September 2016.

On April 28, 2016 at 6 p.m. at Fire Department. 9 Landowners or 13 people attended the meeting that lives east of SHF plant met with Gary Godfrey. Mr. Godfrey ask us 9 landowners to sell our homes and land to TVA. Mr. Godfrey said he would pay us "WELL"!!!
Quote from Gary Godfrey:
I have the check book. I will pay you "WELL". I will make you very happy with my offer to you.

Godfrey said, to price our land, homes, trees, plants, pools, storm shelters, and etc. At what it
would cost us to replace it at today's price. We all worked for a month calling and getting prices
from contractors on replacement price for our homes, land and landscaping. First offer Gary
Godfrey would "NOT" show any 9 landowners our appraisal on land and homes. First offer was 55
extremely low. Second offer was only 10% more than the first offer.

Every land owner gave Gary Godfrey, our lowest buy out price that we would except for our home and land. This was a reduce price or our rock bottom price that we would except and not a penny less. To replace all that we have now.

6 Landowners have been debt free for years. We have great neighbors, quite peaceful living with great view of wild life. TVA wants to destroy our health, our peaceful living, containment our soil, water, and the air we breath.

Every landowner has found a new place to relocate. Either to build or purchase another place with land. Mr. Godfrey promised all of us the moon. TVA's offer is so low that everyone would have to go in debt to replace what we have now. I'm not going from a brick home, large garage. Concrete driveway, fantastic concrete flower beds and 10.5 acres. To nothing and back in debt.

Gary Godfrey said the reason TVA wanted to acquire all land from TVA railroad spur, to west of Metropolis Lake Road, to Shawnee Steam Plant, was to build a Natural Gas Steam Plant. Godfrey stated this “3” times in that meeting. That we would not like hearing the noise and daily activity from the new gas plant.

I worked at Shawnee Fossil Plant as a pipefitter, welder and a foreman for 23 years.
Construction, hourly and annual. So I know the operation all over the plant. Inside the plant and 55
outside the plant in Coal Yard, Bag house, and slurry ponds.

Shawnee tries to be a good neighbor and steward of the land. Why else would I have built my home here 24 years ago.

But this is a lousy offer from TVA. It is an insult to all of us.

Gary Godfrey is a lying shyster!!!!

Phyllis J. Robertson Title: Landowner
8935 Gipson Rd
West Paducah, KY. 42086

Email: pjrobertson1953@gmail.com
probertson@brtc.net

Phone. Home 270-488-3703
Cell 270-816-1166

Public Scoping Comment Form

Shawnee Fossil Plant Coal Combustion Residual Management Project
Environmental Impact Statement (EIS)

We want your comments! If you have any issues, concerns, or questions that you would like addressed in the Shawnee Fossil Plant Coal Combustion Residual Management Draft Environmental Impact Statement (EIS), please complete and submit this comment sheet at the scoping meeting to ensure your input is considered. You can also drop the comment sheet in the mail to the address on the reverse side of this sheet. Fold the comment sheet on the lines with the return address showing, tape it closed, affix a stamp, and mail. You may attach additional pages. Please submit your comments by ***December 1, 2016***.
You may also submit comments by e-mail to Ashley Pilakowski, aapilakowski@tva.gov.

For your comments to be the most effective, TVA suggests the following guidelines:

- Keep your comments focused on the proposed project;
- Submit your comments on potential impacts and ideas for project alternatives; and
- Submit your comments within the timeframes announced. This helps the agencies include all concerns in the Draft EIS document.

If you have no comments or questions, but would like to be on our mailing list and receive a copy of the Draft EIS, please complete the contact information below. 53

My Concern is About Ambulance And Fire Department Being Able to get to Anyone on Other Side of Train Track. We live on Corner of Anderson Road and Metropolis Lake Rd. If or When There is emergency And Train is Over Track at This Time we have only one way in or out. It is a Concern for many of us on That end of Metropolis Lake Rd.

Thank you
Donna Forger Bush

Please provide your contact information. If you would like to receive copies of the Draft EIS, please fill in the box on the reverse side and submit this form.

Before including your address, phone number, e-mail address or any other personally identifying information in your comment, you should be aware that your entire comment – including personal identifying information - may be made publicly available at any time. While you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Name:______________________ Title:______________________

Organization:______________________

Mailing address:______________________

City, State, Zipcode:______________________

E-mail:______________________ Phone:______________________

Thank you for your interest and participation!

Name: Laurence Drown

Comments: I operated units at Shawnee for several years, beginning with the AFBC pilot, then AFBC demo Plant (Unit 10). It has always bothered me that TVA did not complete one of the stated goals of the AFBC program...the utilization of the waste products as commodities in their own right. 56

As the flyash and AFBC bed material were 'stored' separately why are they not now utilized, sold, etc. rather than be 'converted?

That would seem much more aligned with TVA's mission and goals.

Thank You,

Laurence Drown

close window

Appendix D: Scoping Meeting Materials

This page intentionally left blank

Shawnee Coal Combustion Residuals Management Program –Fact Sheet

The Shawnee Fossil Plant is a 1,205 megawatt, coal-burning power plant with nine generating units located in McCracken County, Kentucky, on the Ohio River.

- As part of an effort to manage the disposal of CCR materials on a dry basis, and to meet new CCR regulations, TVA is proposing to close its current landfill and Ash Pond 2 according to the CCR Rule and build and operate a new dry CCR landfill.

- We are in the Scoping phase of the project and are asking for public input on what we should include in the EIS. The scoping comment period runs through Dec. 1, 2016.

- This Environmental Impact Statement (EIS) supports TVA's goal to eliminate wet ash storage at its coal plants and the overall CCR management program at Shawnee Fossil Plant. The new dry landfill will meet the federal rule on coal combustion residuals and state permitting requirements.

- A portion of this EIS will tier from TVA's 2016 Programmatic Environmental Impact Statement that analyzed methods for closing CCR impoundments at TVA fossil plants system-wide and identified specific screening and evaluation factors to help frame assessment of closures at its facilities.

- TVA will evaluate the closure alternatives for the existing CCR Ash Pond 2, analyze the impacts of the closure of the existing Special Waste Landfill, and study the construction and operation of a new on-site CCR landfill to accommodate future dry coal ash disposal.

- The safety of the public and employees are key factors in TVA's decision making process.

- Currently, Ash Pond 2 receives the process flows from the plant along with other noncontact sump flows from the site.

- We are in the process of building a dewatering facility that will handle this waste in the future to allow for dry handling of CCR at the plant. Once complete the CCR from the new dewatering facility will be disposed of in the existing landfill until the decision regarding an alternative disposal facility is made and that facility is available.

- The current onsite Special Waste Landfill is expected to reach capacity within 11 years. TVA has identified the need for additional long-term storage of dry CCR materials produced at SHF, as well as the need to close existing wet storage impoundments.

- The proposed action at SHF is to implement projects that will help TVA handle and dispose of CCR on a dry basis. These projects include:
  - Construction and operation of a new CCR landfill on the SHF site.
  - Closure of the existing Special Waste Landfill;
  - Closure of Ash Pond 2

- A range of alternatives and specific screening criteria were identified for each of the proposed projects.

- In 2015, TVA conducted the New Landfill Siting Study to evaluate potential locations for the new CCR landfill.
- A facility located on a 230 acre property east of and adjacent to the SHF was identified as the most feasible onsite landfill option in the siting study. This onsite landfill is carried forward for analysis as an alternative in this EIS.
- Closure options for Ash Pond 2 include closure-in-place and closure-by-removal.
- Based on screening criteria, TVA has determined there are three alternatives available: (A) No Action; (B) Construction of an onsite dry CCR landfill and closure-in-place of the Special Waste Landfill and Ash Pond 2; or (C) Offsite disposal of dry CCR and closure in place of the Special Waste Landfill and Ash Pond 2.
- The Environmental Impact Statement (EIS) will inform TVA decision makers and the public about the environmental consequences of the proposed action.
- The Draft of the EIS is expected in spring 2017.
- Send comments to Ashley Pilakowski, NEPA Compliance Specialist, by mail at Tennessee Valley Authority, 400 W. Summit Hill Dr., Tennessee, 37902; by email at aapilakowski@tva.gov; or online at www.tva.gov/nepa.

Scope of the Analysis

The following resources have the potential to be affected by the proposed action:

Air Quality	Materials
Climate Change	Safety
Land Use and Prime Farmland	Noise
Aquatic Ecology	Natural Areas, Parks and Recreation
Wildlife	Cultural and Historical Resources
Vegetation	Socioeconomics
Threatened and Endangered species	Environmental Justice
Floodplains	Transportation (Rail, Barge, and Roadway)
Wetlands	Solid and Hazardous Waste and Hazardous
Geology and Groundwater	Visual Resources
Surface Water	

N

0 0.75 1.5 Miles

LEGEND:

Site Boundaries

- Proposed Landfill Foot Print
- Site Boundary
- Shawnee Fossil Plant

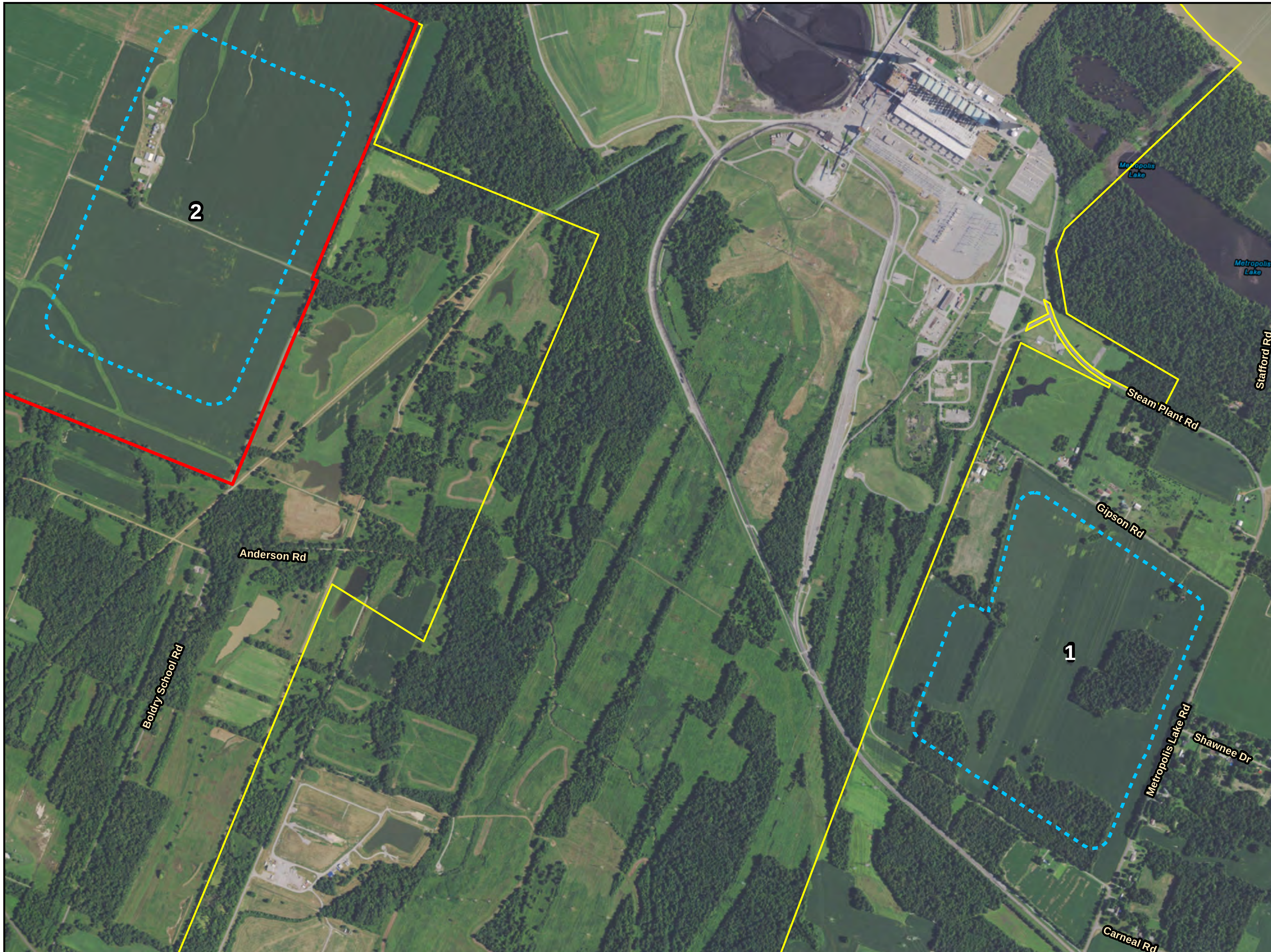
BASE MAP SOURCE: ESRI World Imagery 2014

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant
Landfill Siting Study

DATE: 11/9/2016	FIGURE:
DRAWN BY: DCW	CHECKED BY: CF
1 in = 3,788 ft	JOB NUMBER:

G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Landfill Siting Study (aerial).mxd



N

0 1,000 2,000 Feet

LEGEND:

Site Boundaries

- Proposed Landfill Foot Print
- Site Boundary
- TVA Property

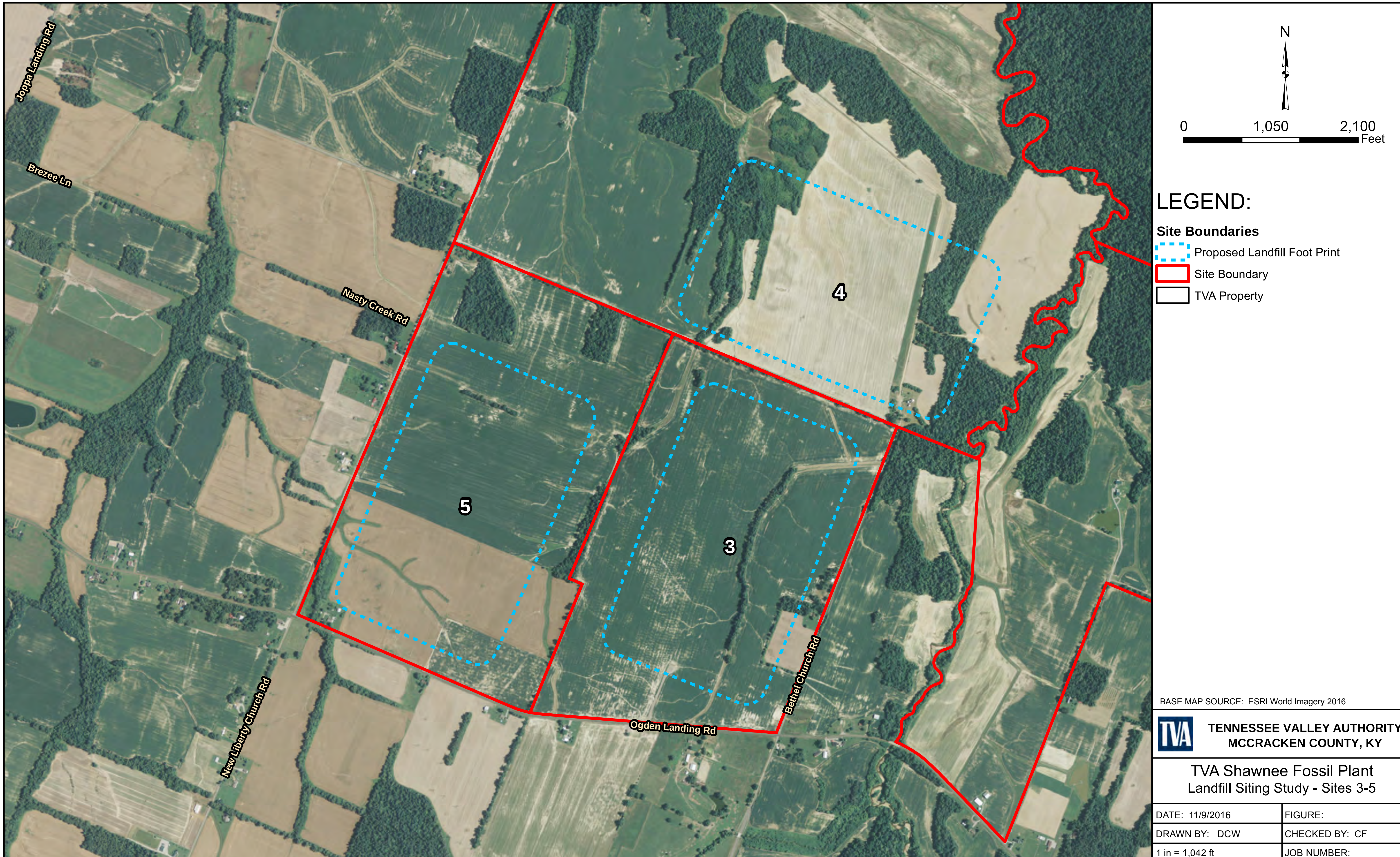
BASE MAP SOURCE: ESRI World Imagery 2016

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant
Landfill Siting Study - Sites 1-2

DATE: 11/10/2016	FIGURE:
DRAWN BY: DCW	CHECKED BY: CF
1 in = 985 ft	JOB NUMBER:

G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Landfill Siting Study - Sites 1-2.mxd



BASE MAP SOURCE: ESRI World Imagery 2016

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant
Landfill Siting Study - Sites 3-5

DATE: 11/9/2016	FIGURE:
DRAWN BY: DCW	CHECKED BY: CF
1 in = 1,042 ft	JOB NUMBER:

G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Landfill Siting Study - Sites 3-5.mxd

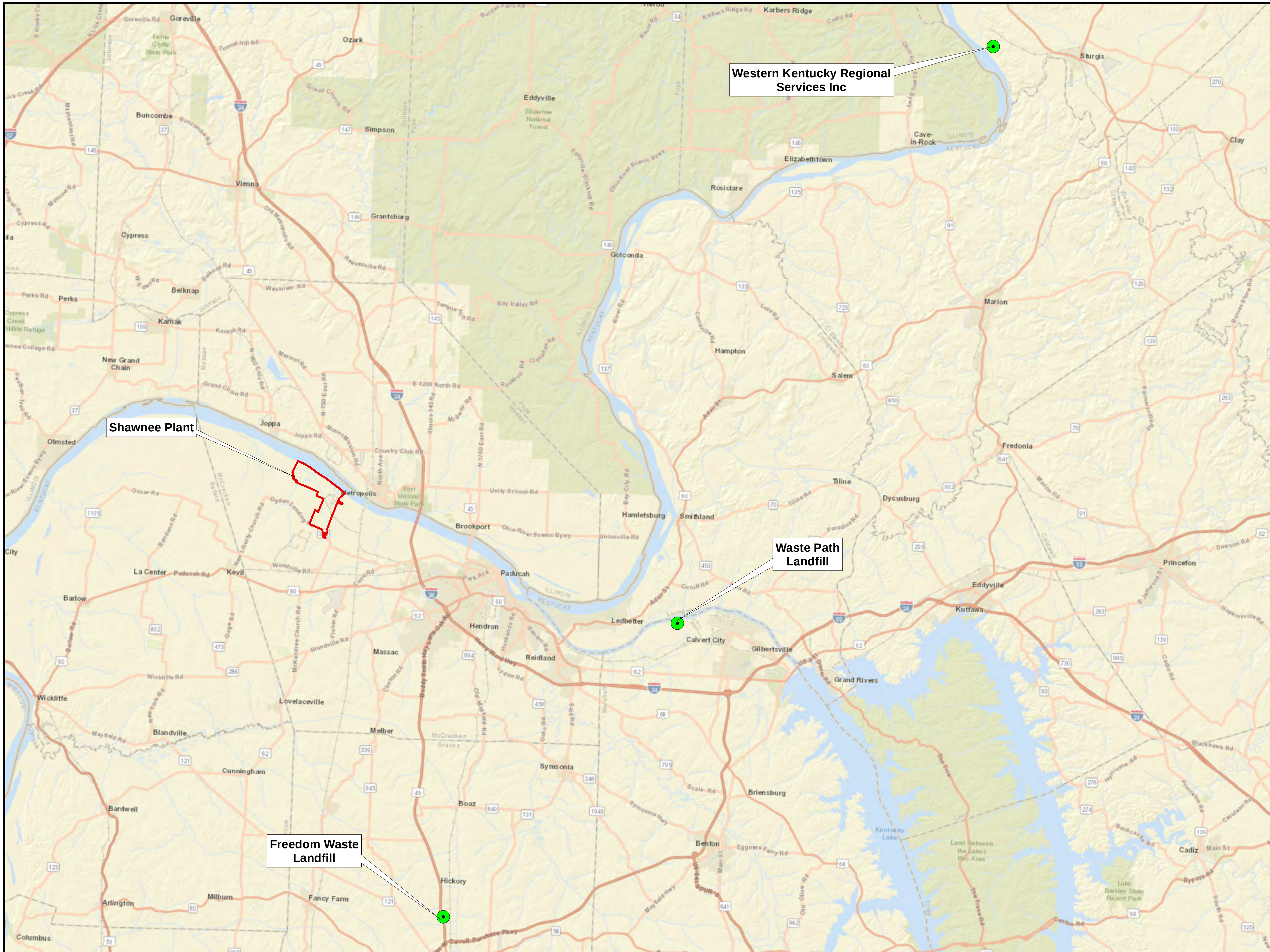
BASE MAP SOURCE: ESRI World Imagery 2016

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant
Landfill Siting Study - Site 6

DATE: 11/9/2016	FIGURE:
DRAWN BY: DCW	CHECKED BY: CF
1 in = 799 ft	JOB NUMBER:

G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Landfill Siting Study - Site 6.mxd



N

0 5 10 Miles

LEGEND:

Shawnee Fossil Plant

Proposed Offsite Alternative Landfill Sites

BASE MAP SOURCE: ESRI World Imagery 2016

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant
Proposed Offsite Alternative Landfill Sites

DATE: 11/10/2016	FIGURE:
DRAWN BY: DCW	CHECKED BY: CF
1 in = 30,233 ft	JOB NUMBER:

G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Offsite Landfill Alternatives.mxd

N

0 1,450 2,900 Feet

LEGEND:

Site Boundaries

- Shawnee Fossil Plant
- Proposed New CCR Landfill
- Ash Pond 2
- Existing Special Waste Landfill

BASE MAP SOURCE: ESRI World Imagery 2016

TVA

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant
Proposed Action

DATE: 11/14/2016	FIGURE:
DRAWN BY: DCW	CHECKED BY: CF
1 in = 1,446 ft	JOB NUMBER:

G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Proposed Action.mxd

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant
Proposed New CCR Landfill

DATE: 11/14/2016	FIGURE:
DRAWN BY: DCW	CHECKED BY: CF
1 in = 633 ft	JOB NUMBER:

G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\New CCR Landfill.mxd

Appendix B – Vegetation Field Survey Report

Appendix B – Vegetation Field Survey Report

Vegetation Field Survey Report
Shawnee Fossil Plant (SHF)
McCracken County, KY

December 2016

Prepared for:
Tennessee Valley Authority

Prepared by:
AECOM
10 Patewood Drive, Suite 500
Greenville, SC

Vegetation Field Survey Report
Shawnee Fossil Plant, McCracken County, KY

1.1 General Vegetation

Shawnee Fossil Plant (SHF) is located within the Wabash-Ohio Bottomlands Level IV ecoregion (Woods et al. 2002). This unglaciated, level floodplain along the Ohio River was historically southern floodplain forest, a mix of oaks, cypress, and hardwood species. This region has been largely drained and converted for commercial and agricultural use. SHF is mostly an intensely developed site that has been heavily disturbed by construction, maintenance, and operation of the facility. As a result of this alteration of the physical landscape, most areas within SHF no longer support a natural plant community. Within the project area, the land use is classified as developed, low intensity, and the vegetation consists of plants typical of disturbed or landscaped areas.

The proposed new dry CCR landfill site property is bordered to the east by Metropolis Lake Road, to the north by Gipson Road and residential property, to the west by a transmission line right-of-way and additional TVA property, and to the south by a residential property on Metropolis Lake Road. The majority of the area has been previously disturbed by farming. Land use within a 5-mile radius of the proposed landfill site consists of agricultural, residential, rural, and commercial activities (TVA 2016). Vegetation within 5 miles of the project area is primarily cultivated crops, deciduous forest, and pasture land. The surrounding region also contains small amounts of woody wetlands, evergreen forests, grassland, and shrub/scrub.

A field survey was conducted by AECOM in November 2016 to evaluate land cover, threatened and endangered species, and forest composition within the 330-acre proposed new dry CCR landfill site. AECOM observed vegetation within the site was primarily converted cropland, deciduous forest, woody wetlands, and grassland, Figures 1-4.

1.2 Proposed Project Area Vegetation

The proposed new dry CCR landfill property includes three distinct vegetation communities: old fields, wet woodlands, and dry upland woodlands. Old fields are heavily disturbed ex-cropland areas consisting of bush-hogged weeds and grasses with no trees or woody shrubs. Much of the land is historically agricultural fields sparsely vegetated with early successional herbaceous species and few wetland depressions. The agricultural land was not cultivated in 2016 and has grown up in weeds/shrubs and grass that is mowed.

Old field (OF) communities were surveyed in three areas within the proposed landfill property. OF-1, OF-2, and OF-3 are located on a 110-acre parcel south of Anderson Road on the south side of the railroad tracks (Figure 2). Dominant species include panicum grass, goldenrod, barnyard grass, ragweed, broomsedge, and flatsedge, with a few patches of Johnson grass, pathrush, *Eleocharis* spp., *Carex* spp., and fescue. OF-17 is located on a 30-acre tract of land on the east side of Metropolis Lake Road and is bounded by patchy forested areas (Figure 3). Dominant species included barnyard grass, broomsedge, fleabane, goldenrod, flatsedge, Johnson grass, hairy hawkweed, ground cherry, and yellow hop clover. A few sweetgum and poplar sprouts were observed with sassafras and sumac saplings bordering the edges. The third old field area (OF-4) lies within the footprint of the proposed landfill north of Anderson Road (Figure 4). The tract is fragmented by patchy forested areas and a few wetland depressions. Old fields in this area are recently converted cropland with residual corn root stubble, but the land was not cultivated in 2016. Thus, the area has grown up in weeds/shrubs and mowed grasses including panicum, broomsedge, flatsedge, Johnson grass, and hairy hawkweed.

Wet woodland (WW) communities were observed within or adjacent to wetland depressions within the proposed landfill property. Little to no invasive species were observed in wet woodland areas. The northern side of the 30-acre tract east of Metropolis Lake Road is a cove forest containing a wet woodland area (F17-2-WW). The area is dominated by deciduous tree species (hackberry, box elder, black cherry, black locust, and red maple) with a more densely established understory of woody vines (honeysuckle, trumpet vine, and multiflora rose). Wet woodland areas (F20-WW and F9-WW) in the proposed landfill footprint north of Anderson Road were bottomland forests situated adjacent to wetland depressions and wet-weather conveyances. F20-WW lies within a dry wetland depression and is composed of shade-tolerant, bottomland species, including sugarberry, red maple, American sycamore, and pecan, with a few southern red oaks along the edges. F9-WW is located within a wetland area adjacent to a wet-weather conveyance and is dominated by deciduous bottomland tree species (sugarberry, American elm, red maple, buttonbrush, and sweetgum) and woody vines (trumpet creeper, honeysuckle, poison ivy, and coral berry). Wet wooded areas located south of the railroad tracks were observed throughout the 9-acre wetland. The species composition of F16-A-WW resembled more of an alluvial bottomland deciduous forest, including river birch, red maple, green ash, pin oak, and American elm.

Dry upland woodland (DUW) communities are mostly mixed mesophytic forests dominated by deciduous oaks and hickories. Dry upland woodlands observed in the area of the proposed landfill footprint (F10-DUW, F11/12-DUW, F7-DUW, F15-DUW, and F1-6-DUW) north of Anderson Road were all dominated by an oaks and hickories. The species composition was relatively homogeneous across upland woodland areas in this tract. Dominant species were southern red oak, mockernut hickory, turkey oak, shagbark hickory, post oak, pin oak, white oak, northern red oak, hackberry, white ash, sassafras, prickly ash, black cherry, American elm, and persimmon. Woody vines (coral berry, honeysuckle, trumpet vine, and blackberry) were abundant throughout upland woodland plots. The species composition of dry upland woodland areas on the tract east of Metropolis Lake Road varied. The F17-1-DUW and F17-3-DUW communities included less of an oak-hickory component and more of deciduous mesic species. Dominant species observed were black locust, hackberry, sweetgum, American elm, southern red oak, sassafras, honey locust, mulberry, sycamore, red maple, and persimmon. Invasive species were abundant, including periwinkle (30 percent), Chinese privet (10 percent), multiflora rose (5 percent), and autumn olive (5 percent). Dry upland woodland areas F16-B-DUW and F13-DUW are located on the parcel south of Anderson Road on the south side of the railroad tracks. Dry upland woodlands in these areas were homogeneous in regard to species composition, with southern red oak, post oak, white oak, mockernut hickory, shagbark hickory, and pin oak in abundance. Sassafras, black cherry, prickly ash, persimmon, blackhaw, sweetgum, and winged elm were also observed.

1.3 Threatened and Endangered Vegetation

In addition to plant species that are federally listed as threatened or endangered under the Endangered Species Act, the State of Kentucky also provides protection for species considered threatened, endangered, or in need of management within the state (Kentucky Department of Fish and Wildlife Resources [KDFWR] 2013). The state listing of species is managed by the KDFWR. The Kentucky State Nature Preserves Commission (KSNPC) and TVA both maintain databases of aquatic and terrestrial species that are considered threatened, endangered, of special concern, or are otherwise tracked in Kentucky because the species is rare and/or vulnerable within the state. Plant species are protected in Kentucky through the Kentucky Rare Plant Recognition Act of 1994. No endangered or threatened plant species were observed during forest composition surveys in any of the offsite property areas.

There are no federally listed plant species with recorded occurrences in McCracken County. However, there are 28 state-listed plant species with recorded occurrences in McCracken County. Habitat requirements for each of these species are presented in Table 1.1. Based on the vegetation field survey conducted by AECOM, preferred habitat for the majority of species was observed throughout the proposed new dry CCR landfill site property. A review of the TVA Natural Heritage Database indicated that only two of the state-listed plant species (water hickory and star tickseed) have recorded occurrences within a 5-mile radius of SHF. The KSNPC database identified water hickory as well as four additional species as occurring within 1 mile of the proposed landfill site: common silverbell, snow squarestem, hair grass, and trepocarpus (Table 1.1). These species are discussed below.

Water hickory *(Carya aquatica*) is a large tree species associated with bottomland forests and floodplain swamps that have standing water for a portion of the year (NatureServe 2016). Wet woodland areas in the proposed landfill property could provide low quality habitat for the water hickory, but due to the land's repeated disturbance it is unlikely that the species would establish in such fragmented patches of wet woodland areas. No individuals of this species were observed by AECOM during the vegetation survey of the proposed new dry CCR landfill property.

Star tickseed (*Coreopsis pubescens*) is a perennial herb associated with open woodlands, dry slopes and cliffs, and back-edges of boulder-cobble bars near riverbanks (NatureServe 2016). The star tickseed has also been recorded to establish along the edges of forested wetlands. There is a potential that the star tickseed could survive in dry upland woodland areas on the proposed new dry CCR landfill property, but no individuals of this species were observed by AECOM during the vegetation survey.

Common silverbell (*Halesia carolina*) is state listed as endangered. It is a small tree that prefers moist soils along streams in the understory of hardwood forests (Burns and Honkala 1990). Its habitat also includes rich woods and the edges of sloughs and oxbow lakes, and it has been recorded within 1 mile of the proposed dry CCR landfill property (KSNPC 2016). Common silverbell was not observed during the vegetation survey.

Snow squarestem (*Melanthera nivea*) has a state status of special concern. It is a perennial herb associated with floodplains and wet/moist sandy woods, including disturbed openings, and it has been recorded within 1 mile of the proposed dry CCR landfill property (KSNPC 2016). Common silverbell was not observed during the vegetation survey.

Hair grass (*Muhlenbergia glabrifloris*) has a state status of special concern. It is a perennial grass with erect stems approximately 3 feet tall. It tends to occur in areas where there has been repeated disturbance, and it can occur in two very different types of habitats: dry soils of prairies, gravels, and rocky slopes, generally at the edges of forests; and wet soils of bottomland woods and at the edges of marshes (KSNPC 2016). Hair grass has been recorded within 1 mile of the proposed dry CCR landfill property, although that observation is historical from 1977 (KSNPC 2016). Hair grass was not observed during the vegetation survey.

Trepocarpus (*Trepocarpus aethusae*) has a state status of special concern. It is an annual herb and a wetland species that is associated with the margins of swamp forests, sandy river bottoms, and exposed shorelines. It has been recorded within 1 mile of the proposed dry CCR landfill property (KSNPC 2016). Trepocarpus was not observed during the vegetation survey.

Table 1.1 Vegetation Species of Conservation Concern Documented in McCracken County, Kentucky

Common Name	Scientific Name	Status		Habitat Requirements	Presence of Habitat in Proposed Project Area
		Federal	State (Rank)		
Red Buckeye	*Aesculus pavia*	--	THR(S2S3)	Swamp forests and rich damp woods[1]	Swamp forests and damp woods are present in wetlands and forested areas.
Lakecress	*Armoracia lacustris*	--	THR(S1S2)	Sloughs, cypress swamps, slow water[1]	Habitat not present in project area
Cream Wild Indigo	*Baptisia bracteata var. Glabrescens*	--	SPCO(S3)	Prairies and open dry woods[1]	Habitat is present in dry upland woodlands and potentially in old field areas.
Broadwing Sedge	*Carex alata*	--	THR(S1S2)	Peaty shores, marshes, wet thickets, woods[2]	Wet thickets and woods are present in wet woodlands and forested areas.
Porcupine Sedge	*Carex hystericina*	--	HIST(SH)	Open swamps, sedge meadows, ponds, in calcareous substrates[1]	Limited similar habitat present with the exception of small ponds.
Water Hickory*	*Carya aquatica*	--	THR(S2S3)	Bottomland and floodplain swamps[1]	Bottomland and floodplain swamps are not present.
Five-lobe Cucumber	*Cayaponia quinqueloba*	--	END(S1?)	Bottomlands along bayous, swamp forests, riverbanks[1]	Habitat not present
Rose Turtlehead	*Chelone obliqua var. speciose*	--	SPCO(S3)	Floodplain and alluvial forests, swamps and sloughs[1]	Habitat not present
Star Tickseed*	*Coreopsis pubescens*	--	SPCO(S2S3)	Open woods, dry slopes and cobble bars near Riverbanks[1]	Open woods habitat present in wooded areas.
Water Locust	*Gleditsia aquatica*	--	SPCO(S3?)	Rivers, swamps and slough margins[1]	Habitat not present
Common Silverbell	*Halesia carolina*	--	END(S1S2)	Rich woods and edges of sloughs and oxbow lakes[1]	Rich woods and sloughs are present in forested wetland areas.
Broadleaf Golden-aster	*Heterotheca subaxillaris* var. *latifolia*	--	THR(S2)	Dry, sandy places and disturbed sites[1]	Some old field areas provide dry and disturbed sites.
Ovate Fiddleleaf	*Hydrolea ovata*	--	END(S1)	Swamps and wet woods[1]	wet woods are present throughout the property in forested wetland areas.
One-flower Fiddleleaf	*Hydrolea uniflora*	--	END(S1)	Swampy woodlands, pond margins and wet ditches[1]	Swampy woodlands, pond margins, and wet ditches are present throughout wetlands, old field areas, and wet woodlands.
Creeping St. John's-wort	*Hypericum adpressum*	--	HIST(SH)	Acidic soils of fresh water open wetland areas[5]	Habitat lacking, the small ponds are small and shaded
Zigzag Iris	*Iris brevicaulis*	--	THR(S1S2)	Forested and open wetlands, shorelines[1]	Forested wetland areas are present in the property.
Tall Bush-clover	*Lespedeza stuevei*	--	THR(S2S3)	Dry woodlands[1]	Dry woodlands and upland areas are present throughout the property.
Snow Squarestem	*Melanthera nivea*	--	SPCO(3?)	Floodplains and wet sandy woods[1]	Habitat not present
Spotted Bee-balm	*Monarda punctate*	--	EXP(SX)	Sandy prairies and other sandy habitats[1]	Habitat not present
Hair Grass	*Muhlenbergia glabrifloris*	--	SPCO(S2S3)	Dry/baked soils in prairies, rocky slopes, marsh edges of bottomland woods[1]	Habitat not present
Broadleaf Water-milfoil	*Myriophyllum heterophyllum*	--	SPCO(S3?)	Ponds, ditches, slow streams[1]	Ponds and wet ditches are present. streams were small and dry – habitat lacking.
Spotted Pondweed	*Potamogeton pulcher*	--	THR(S1S2)	Ponds, slow streams, swamps[1]	Ponds and swampy lands are present in wetlands and bottomland forests.
Rough Rattlesnake-root	*Prenanthes aspera*	--	END(S1)	Dry prairies, limestone glades, open rocky woods in acidic soils[1]	Habitat not present, rocky soil lacking
Sweet Coneflower	*Rudbeckia subtomentosa*	--	END(S1)	Prairies and open low areas[1]	Prairies absent, open low areas are present in old field areas.

Common Name	Scientific Name	Status		Habitat Requirements	Presence of Habitat in Proposed Project Area
		Federal	State (Rank)		
Compass Plant*	*Silphium laciniatum*	--	THR(S2)	Prairies and barrens[1]	Prairies and barrens are not present.
Buckley's Goldenrod	*Solidago buckleyi*	--	SPCO(S2S3)	Dry mesic woods[1]	dry mesic woods present
Pale Manna Grass	*Torreyochloa pallida*	--	HIST(SH)	Bogs, fens, wetland habitats[5]	Wetland habitat is present throughout the property.
Trepocarpus	*Trepocarpus aethusae*	--	SPCO(S3)	Margins of swamp forests and sandy river bottoms[1]	Habitat not present

1 Source: Kentucky Department of Fish and Wildlife 2015, TVA Regional Natural Heritage Database, KSNPC, and the USFWS for Planning and Conservation (IPaC), accessed March 2016

2 Federal Status Codes:
DM = Delisted, Recovered, and Being Monitored
LE = Listed Endangered
LT = Listed Threatened;
PE = Proposed Endangered
C = Candidate for federal listing
S = partial status (subspecies listed in Midwest

3 State Status Codes:
END = listed endangered
NMGT = Listed in Need of Management
TRKD = tracked as sensitive but has no legal status
SPCO = species of special concern
THR = listed threatened
HIST = State Historic

4 State Rank:
S1 = Extremely rare and critically imperiled
S2 = Very rare and imperiled
S3 = Vulnerable
S4 = Apparently secure, but with cause for long-term concern
SH = Historic in Kentucky;
S#S# = Denotes a range of ranks because the exact rarity of the element is uncertain (i.e.S1S2)
S#? = Inexact rank

5 NatureServe 2016

*Species with documented occurrences within 5 mi of SHF (TVA Regional Natural Heritage Database).

1.4 Invasive Plant Species

Most lands in and around the TVA power service area have been affected by introduced, non-native, plant species. According to NatureServe (2016), invasive, non-native species are the second leading threat to imperiled native species. Invasive plant species erode forest productivity and degrade diversity of wildlife habitat. Some have been introduced into this country accidentally, but most were brought here as ornamentals or for livestock forage. These exotic plants arrived without their natural predators of insects and diseases that tend to keep native plants in natural balance. As a result, invasive species are able to out-compete native vegetation for available resources, such as nutrients, space, and water (Miller 2003).

Invasive plant species were most abundant in the dry upland woodland areas of the proposed landfill property. The most common species were *Microstegium vimineum* (Japanese stiltgrass) and *Ligustrum sinense* (Chinese privet). Both species tended to associate with dry open woodland communities, but were found in other vegetation communities as well, such as in moist woodlands and near wetlands. Total cover of Chinese privet was approximately 10 percent across the entire landfill property. Cover of Japanese stiltgrass was approximately 20 percent. *Sorghum halepense* (Johnson grass) was another invasive species that was commonly seen occupying the edges of dry woodland areas, and it was common in old fields. Total coverage of Johnson grass in old fields ranged between about 10 and 25 percent. Other invasive species observed included *Celastrus orbiculatus* (bittersweet vine), *Rosa multiflora* (multiflora rose), *Vinca minor* (common periwinkle), *Elaeagnus umbellata* (autumn olive), and *Phragmites australis* (phragmites). These species were sparsely distributed throughout the proposed new dry CCR landfill property.

References

Kentucky Department of Fish and Wildlife Resources (KDFWR). 2013. Kentucky's Comprehensive Wildlife Conservation Strategy. #1 Sportsman's Lane, Frankfort, Kentucky 40601. http://fw.ky.gov/WAP/Pages/Default.aspx (Date updated 2/5/2013).

Kentucky Department of Fish and Wildlife Resources (KDFWR). 2016. Southeastern *Myotis* Species Information. Retrieved from http://fw.ky.gov/Wildlife/Pages/Southeastern-Myotis.aspx (accessed March 2016).

Kentucky State Nature Preserves Commission (KSNPC). 2015. County Report of Endangered and Special Concern Plants, Animals, and Natural Communities of Kentucky. 801 Teton Trail, Frankfort, KY 40601. Retrieved from www.naturepreserves.ky.gov (accessed March 2016).

Miller, J.H. 2003. *Non-native Plants of Southern Forest.* Asheville, North Carolina: United States Department of Agriculture, Forest Service Tech. Rep. SRS-62.

NatureServe. 2016. NatureServe Explorer: An Online Encyclopedia of Life, Web Service. Arlington, VA. U.S.A. 2016. Retrieved from http://services.natureserve.org (accessed March 2016).

Tennessee Valley Authority. 2016. Shawnee Fossil Plant Bottom Ash Process Dewatering Facility: Final Environmental Assessment, McCracken County, Kentucky. September 2016.

United States Fish and Wildlife Service. 2016. Information for Planning and Conservation (IPaC) Trust Resources Report. Retrieved from https://ecos.fws.gov/ipac/ (generated October 17, 2016).

Woods, A.J., Omernik, J.M., Martin, W.H., Pond, G.J., Andrews, W.M., Call, S.M, Comstock, J.A., and Taylor, D.D., 2002, Ecoregions of Kentucky (color poster with map, descriptive text, summary tables, and photographs): Reston, VA., U.S. Geological Survey (map scale 1:1,000,000).

Photo Log

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA	SHF	60515229

Photo No.	Date:
1	11/4/16

Direction Photo Taken:

Description:

Old field area south of Anderson Road on the south side of railroad tracks.

Photo No.	Date:
2	11/4/16

Direction Photo Taken:

Description:

Old field area on south side of railroad tracks.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA	SHF	60515229

Photo No.	Date:
3	11/4/16

Direction Photo Taken:

Description:

Old field area north of Anderson Road.

Photo No.	Date:
4	11/4/16

Direction Photo Taken:

Description:

Wet woodland area south of Anderson Road.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA	SHF	60515229

Photo No.	Date:
5	11/4/16

Direction Photo Taken:

Description:

Wet woodland area north of Anderson Road.

Photo No.	Date:
6	11/4/16

Direction Photo Taken:

Description:

Wet wooded area east of Metropolis Lake Road.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA	SHF	60515229

Photo No.	Date:
7	11/4/16

Direction Photo Taken:

Description:

Dry upland woodland area north of Anderson Road.

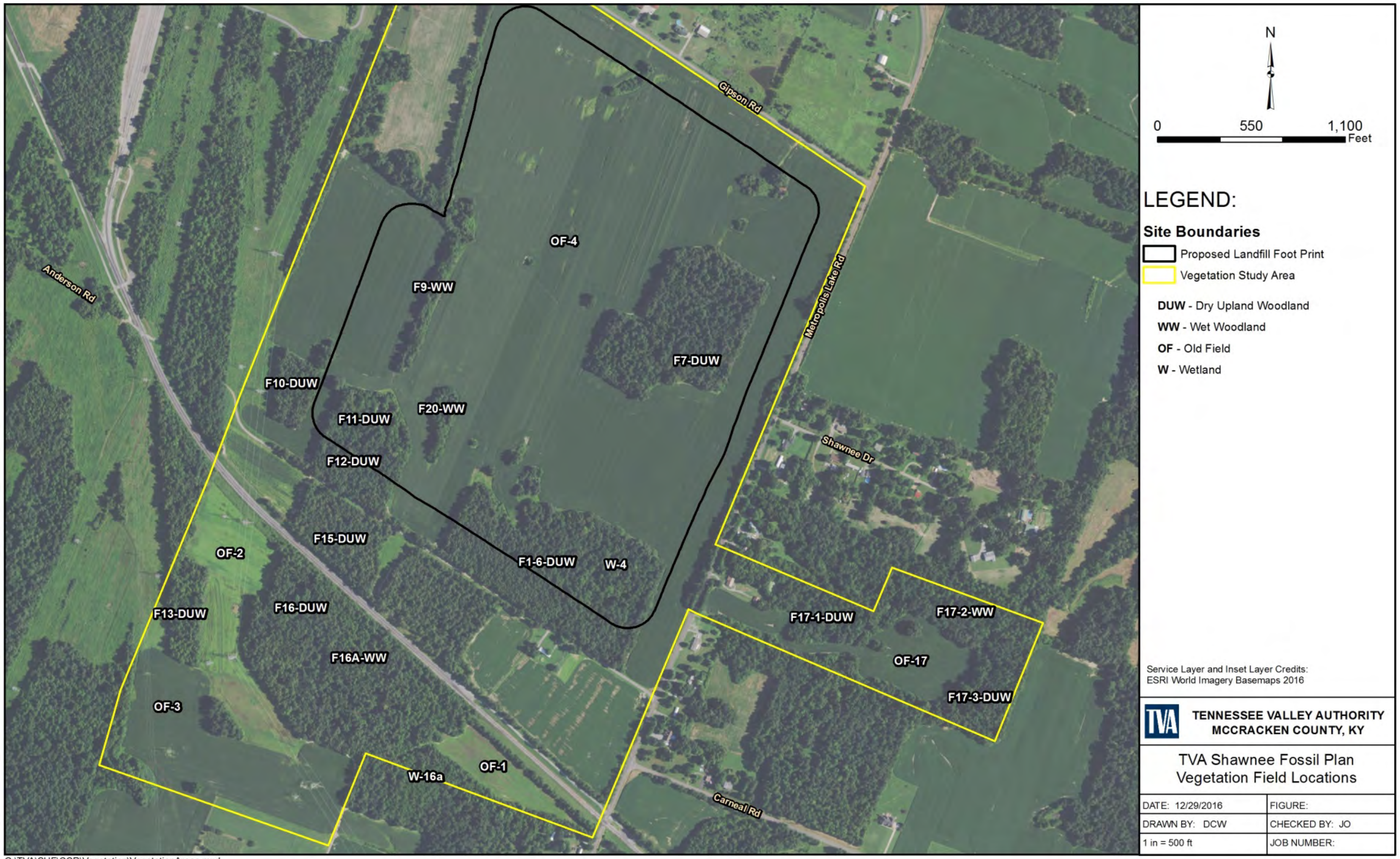
Photo No.	Date:
8	11/4/16

Direction Photo Taken:

Description:

Dry upland woodland area south of Anderson Road.

Figure 1. Vegetation Field Locations



G:\TVA\SHF\CCR\Vegetation\VegetationAreas.mxd

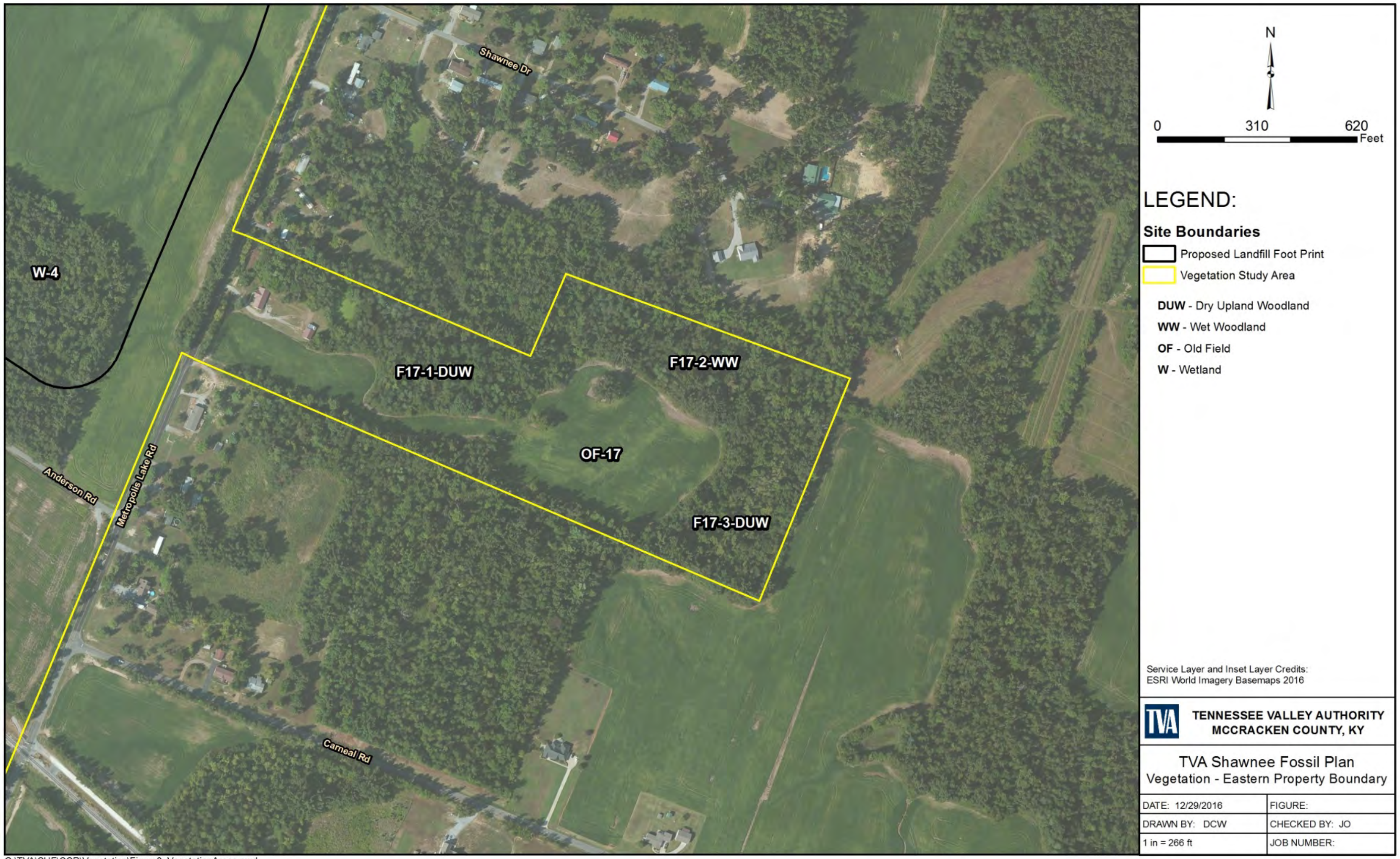
Figure 2. Vegetation, Southern Property Boundary

G:\TVA\SHF\CCR\Vegetation\Figure1_VegetationAreas.mxd

Figure 3. Vegetation, Northern Property Boundary

G:\TVA\SHF\CCR\Vegetation\Figure2_VegetationAreas.mxd

Figure 4. Vegetation, Eastern Property Boundary



G:\TVA\SHF\CCR\Vegetation\Figure3_VegetationAreas.mxd

Appendix C – Bat Habitat Report

Appendix C – Bat Habitat Report

FINAL REPORT

HABITAT ASSESSMENT FOR FEDERALLY LISTED BAT SPECIES

SHAWNEE FOSSIL PLANT COAL COMBUSTION RESIDUAL MANAGEMENT ENVIRONMENTAL IMPACT STATEMENT

McCracken County, Kentucky

February 2017

AECOM

1000 Corporate Centre Drive
Suite 250
Franklin, Tennessee 37067
(615) 771-2480

Introduction

The site of the proposed new landfill at the TVA Shawnee Fossil Plant (SHF) was investigated to evaluate the potential for occurrence of federally listed threatened and endangered species or their habitats. TVA proposes to construct and operate a new coal combustion residual (CCR) landfill that would support TVA's goal to eliminate all wet storage at the SHF, provide additional dry CCR storage, and assist TVA in meeting new CCR regulations. On the site of the proposed landfill, TVA proposes to conduct tree removal, area grading, excavation for foundations, and installation of underground piping and electrical duct banks. The proposed landfill property area of disturbance is approximately 238 acres currently consisting of forested uplands, forested wetlands, old fields, and former cropland (last farmed in 2015). The proposed project actions would include construction of a new dry CCR landfill, stormwater pond, stormwater drainage ditch, leachate pond, and ancillary facility, as well as temporary construction laydown/parking areas. Approximately 68 of the 238 acres are wooded. The property also includes a number of small livestock or wildlife ponds and drainages.

Federally listed species with the potential to occur in the area of the proposed landfill were identified based on review of the TVA Natural Heritage database and the United States Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) database. The data review indicated that federally listed species that might utilize the habitats in the area of the proposed landfill include three species of bats: the gray bat (*Myotis grisescens*) and Indiana bat (*Myotis sodalis*), which are endangered; and the northern long-eared bat (*Myotis septentrionalis*), which is threatened.

The proposed landfill property includes woodlands and former cropland. The gray bat requires caves for roosting throughout the year. However, no caves are known within 5 miles of the project area, and none were observed during field reviews on the project site in November 2016 (TVA 2016). The proposed landfill property does include forested habitat that potentially could be used by the northern long-eared bat and Indiana bat for summer roosting or maternity sites. Therefore, the field study focused on potential impacts to these two bat species and their habitat on the proposed landfill property.

Field Study Results

A Phase 1 Summer Habitat Assessment for the SHF proposed landfill was conducted on November 1 – 2, 2016. The purpose of the assessment was to evaluate whether potential summer roost trees for Indiana or northern long-eared bats are present within the proposed landfill property and the proposed landfill footprint where tree removal is likely. As a result of the habitat assessment, roost trees and roost tree areas were identified by qualified biologists and located by global positioning system (GPS). The proposed landfill property, the proposed landfill footprint within the property, and the survey areas they encompass are delineated in Figure 1.

A photo log of potential roost habitat is provided in Attachment 1. Potential summer roost trees are those that exhibit the preferred habitat qualities of peeling bark, exfoliating bark, or tree cavities. Bat roosting trees can either be live trees or standing dead trees (i.e., snags). In addition, good quality potential Indiana bat and northern long-eared bat habitat includes ready access to foraging areas, as indicated by characteristics such as distinct flying corridors or trees adjacent to foraging areas (2016 FWS Indiana Bat Recovery Plan). A Phase I Bat Habitat Assessment was completed for each area. The assessment data sheets for each area are provided in Attachment 2.

The proposed landfill area of disturbance encompasses approximately 12 wooded areas separated by agricultural fields, roads, and a railroad. The wooded areas are discussed below as Areas 1 - 12 (Figure 1). The proposed landfill footprint and associated facilities encompass approximately 210 acres within the northern and central portions of the landfill property north of Anderson Road. Wooded Areas 1, 2, 3, 4, and 5 are within or adjacent to the proposed footprint of the landfill, the leachate pond, or the ancillary facility and would be cleared. Wooded Areas 6 and 7 are between Anderson Road and the railroad and would be cleared for construction laydown areas, parking, and construction trailers. Areas 8, 9, and 10 are south of the railroad and would not be cleared. Area 11 is within a narrow portion of the property that is located east of Metropolis Lake Road and would not be cleared. Area 12 is located adjacent to the center northwest border of the property and would be cleared (Figure 1).

Wooded Area 1: Area 1 is located along the northern border of Anderson Road in the south-central portion of the proposed landfill property (Figure 1). This area is 20.7 acres total and is planned to be cleared. The woodland is composed of mature hardwood trees with a mixed scrub/shrub understory. This area is bordered on the north, east, and west by agricultural fields/cropland and on the south by Anderson Road. Dominant tree species of Area 1 include shagbark hickory, mockernut hickory, northern red oak, southern red oak, white oak, silver maple, and black cherry. During the field surveys conducted on November 1, approximately 40 mature shagbark hickory trees with exfoliating bark and an additional 15 mature trees with suitable cracks or crevices were noted throughout the area. There is also an abandoned barn structure in the northern corner of Area 1. No evidence of current or past bat habitation was found in the barn at the time of the survey. Due to the presence of snags, standing mature trees with exfoliating bark, and foraging habitat throughout the entire woodland of Area 1, this area represents suitable habitat for Indiana and northern long-eared bats.

Wooded Area 2: Area 2 is located in the central and northwest portion of the proposed landfill property (Figure 1). This area includes 4.8 acres in the footprint of the landfill and is planned to be cleared. It is a combination of two small areas connected by a drainage: a small, forested depression surrounded by former cropland, and a linear woodland bordering two fence rows. The vegetation is composed of mature hardwood trees with a mixed scrub/shrub understory. This area is bordered on all sides by agricultural fields/cropland and mixed grasses. Dominant tree species of Area 2 include eastern cottonwood, white oak, American sycamore, black cherry, common hackberry, northern red oak, black willow, silver maple, and shagbark hickory. During the field surveys conducted on November 1, two mature shagbark hickories, two oaks with large crevices, and two suitable snags were noted within the linear woodland area. Thus, Area 2 contains only six potential roost features and marginal roosting habitat for Indiana and northern long-eared bats.

Wooded Area 3: Area 3 is located in the northeast portion of the proposed landfill property (Figure 1). This area (14.4 acres) is an area bordered on all sides by agricultural fields/cropland. All of Area 3 is located within the footprint of the proposed landfill and would be cleared. The vegetation is composed of mature hardwood trees with a mixed scrub/shrub understory. Dominant trees species of Area 3 include shagbark hickory, white oak, black cherry, winged elm, American elm, northern red oak, and southern red oak. During the field surveys conducted on November 1, approximately 80 mature shagbark hickory trees with exfoliating bark, 15 mature trees with suitable crevices, and three suitable snags were noted. Due to the presence of these trees, their close proximity to agricultural edge habitat, and suitable foraging habitat throughout the entire woodland within Area 3, this area represents 14.4 acres of suitable habitat for Indiana and northern long-eared bats.

Wooded Area 4: Area 4 is located in the west central portion of the proposed landfill property (Figure 1). It is just outside of the landfill footprint but is included in the footprint of the leachate pond and ancillary facility, therefore, it would be cleared. This area (3.2 acres total) is a small woodland bordered on the west by a powerline corridor with mixed grasses, on the north and south by agricultural fields/cropland, and on the east by mixed grasses and woodlands. The vegetation is composed of mature hardwood trees with a mixed scrub/shrub understory. Dominant trees species of Area 4 include hackberry, southern red oak, and black cherry. During the field surveys conducted on November 1, approximately five mature shagbark hickory trees with exfoliating bark, two mature trees with suitable crevices, and three suitable snags were noted. Due to the presence of these five mature shagbark hickories along the woodland edge and two suitable snags within the woodland, Area 4 contains only limited suitable roosting habitat for Indiana or northern long-eared bats.

Wooded Area 5: Area 5 is located east of Area 4 in the west central portion of the proposed landfill property (Figure 1). This area (8.2 acres total) is a woodland bordered to the south by Anderson Road, and to the north, east, and west by agricultural fields/cropland, which separate Area 5 by approximately 100 feet from Areas 2 and 4. The vegetation is composed of mature hardwood trees with a mixed scrub/shrub understory. Dominant trees species of Area 5 include shagbark hickory, southern red oak, northern red oak, bald cypress, hackberry, and sugar maple. During the field surveys conducted on November 1, approximately 17 mature shagbark hickory trees with exfoliating bark, five mature trees with suitable crevices along the woodland edge, and one suitable snag were noted. All of the habitat features were identified in the northern portion of Area 5 away from Anderson Road in an area of approximately 4.5 acres. Due to the presence of crevices and standing trees with exfoliating bark in the northern portion of Area 5, approximately 8.2 acres of marginally suitable habitat for Indiana and northern long-eared bats are present.

Wooded Area 6: Area 6 is located south of Anderson Road in the south-central portion of the proposed landfill property (Figure 1), and it is planned to be cleared. This area (5.9 acres) is a large woodland bordered to the north by Anderson Road, to the south by railroad tracks, to the east by agricultural fields/cropland and Area 7, and to the west by an agricultural field. The vegetation is composed of mature hardwood trees with a mixed scrub/shrub understory. Dominant tree species of Area 6 include black cherry, mockernut hickory, river birch, southern red oak, and shagbark hickory. During the field surveys conducted on November 1, two shagbark hickories were noted. The shagbark hickories were not fully mature and lacked suitable exfoliating bark. Due to the lack of suitable crevices and standing trees with exfoliating bark, this area represents poor quality habitat for Indiana or northern long-eared bats.

Wooded Area 7: Area 7 is located east of Area 6 in the south central portion of the proposed landfill property (Figure 1). This area (9.2 acres) is a large woodland bordered to the north by Anderson Road, to the south by railroad tracks, to the east by an agricultural field/cropland, and to the west by a small grassland and then Area 6. The vegetation is composed of mature hardwood trees with a mixed scrub/shrub understory. Dominant trees species of Area 7 include black cherry, hackberry, southern red oak, and shagbark hickory. During the field surveys conducted on November 1, three shagbark hickory trees and two suitable snags along the woodland edge were noted. The shagbark hickories were not fully mature and lacked suitable exfoliating bark. Due to the presence of only two large snags and the lack of suitable crevices and standing trees with exfoliating bark, this area represents poor quality habitat for Indiana or northern long-eared bats

Wooded Area 8: Area 8 is located in the southern portion of the proposed landfill property (Figure 1). It is not within the proposed landfill footprint and, therefore, is not proposed for clearing at this time. This area (26.7 acres) is a large woodland bordered to the north by railroad tracks, to the south by a powerline corridor with grassland and an agricultural field, to the east by a powerline corridor with grassland, and to the west by an agricultural field. The interior of the woodland contains multiple off-road trails that can act as potential travel corridors for bats. The vegetation is composed of mature hardwood trees with a mixed scrub/shrub understory. Dominant tree species of Area 8 include southern red oak, northern red oak, river birch, and silver maple. During the field surveys conducted on November 1, shagbark hickory trees were not observed. However, approximately 45 suitable snags were noted, many of which stood greater than 20 feet tall with multiple holes or crevices. No mature trees with exfoliating bark were noted. Due to the presence of a substantial number of suitable snags in a large wooded area surrounded by edge habitat and suitable foraging habitat, Area 8 represents suitable habitat for Indiana and northern long-eared bats.

Wooded Area 9: Area 9 is located in the southwestern portion of the proposed landfill property (Figure 1). It is not within the area proposed for clearing. This area (4.38 acres total) is composed of two small woodland areas bordered to the south by an agricultural fields/cropland, to the east and west by powerline corridors and agricultural fields/cropland, and to the north by woodland that continues to the north outside of the proposed landfill property boundary. The vegetation is composed of mature hardwood trees with a mixed scrub/shrub understory. An off-road trail connecting two powerline corridors runs through the northern portion of Area 9 and provides a potential travel corridor for bats. Dominant trees species of Area 9 include southern red oak, red maple, silver maple, pin oak, and shagbark hickory. During the field surveys conducted on November 1, eight mature shagbark hickories with exfoliating bark and four suitable snags were noted. Due to the presence of mature shagbark hickories with exfoliating bark, suitable snags, foraging habitat, and potential travel corridors, this area represents suitable habitat for Indiana and northern long-eared bats.

Wooded Area 10: Area 10 is located in the southwestern corner of the proposed landfill property (Figure 1). It is not within the area proposed for clearing. This area (2.8 acres) is a small woodland area bordered to the north, south, and east by agricultural fields/cropland and to the west by woodland that continues to the west and southwest outside of the proposed landfill property boundary. The vegetation is composed of mature hardwood trees with a mixed scrub/shrub understory. Dominant tree species of Area 10 include southern red oak, winged elm, pin oak, red maple, white oak, American sycamore, and silver maple. During the field surveys conducted on November 1, seven suitable snags and one mature white oak with exfoliating bark along the woodland edge were noted. Due to the presence of a large tree with exfoliating bark, suitable snags, foraging habitat, and close proximity to agricultural edge habitat, this small area represents marginally suitable habitat for Indiana and northern long-eared bats.

Wooded Area 11: Area 11 is located in the eastern portion of the proposed landfill property, east of Metropolis Lake Road (Figure 1). It is not within the area proposed for clearing. This area (19.3 acres) is a large woodland bordered to the west by a residential property, Metropolis Lake Road, and an agricultural field/cropland, to the north by residential properties, to the east by agricultural fields/cropland, and to the south by woodland that continues southward outside of the proposed landfill property boundary. A wide, grassy trail provides a potential travel corridor for bats within the wooded area. The vegetation is composed of mature hardwood trees with a mixed scrub/shrub understory. Dominant trees species of Area 11 include southern red oak, sweetgum, hackberry, red maple, black locust, and honey locust. During the field surveys conducted on November 1, 19 suitable snags along the woodland edge and one mature white oak with exfoliating bark were noted. Due to the relatively low number of suitable trees for the size of this area, Area 11 represents marginally suitable habitat for Indiana and northern long-eared bats.

Wooded Area 12: Area 12 is located along the west-northwest border of the proposed landfill property (Figure 1), adjacent to the proposed location of the stormwater pond. Area 12 (2.0 acres) is a narrow, linear woodland bordered on the north and west by a transmission line right-of-way and on the south and east by former cropland. Area 12 is proposed for clearing to allow for the installation of a stormwater drainage ditch. The ditch would convey stormwater off the proposed landfill property in a corridor that would cross Area 12 before turning north within an existing transmission line right-of-way. This area was not included in the field survey in November 2016: however, it was visited and photographed in February 2017. Based on the photographs, Area 12 appears to include a relatively low number of suitable trees, and this small area represents marginally suitable habitat for Indiana and northern long-eared bats.

Conclusions

This bat habitat assessment was based on a field survey of the woodlands within the proposed area of disturbance where clearing would occur (238 acres), The assessment identified a total of approximately 43 acres of woodlands within the areas to be cleared (all of Areas 1, 3, and 5) for which the quality of the habitat was assessed to be more than marginally suitable for use in roosting by Indiana and northern long-eared bats.

References:

TVA, 2016. Shawnee Fossil Plant Bottom Ash Dewatering Facility Final Environmental Assessment.

United States Fish and Wildlife Service (USFWS). 2016. *2016 Range-Wide Indiana Bat Summer Survey Guidelines, April 2016.* Accessed October 2016. http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html

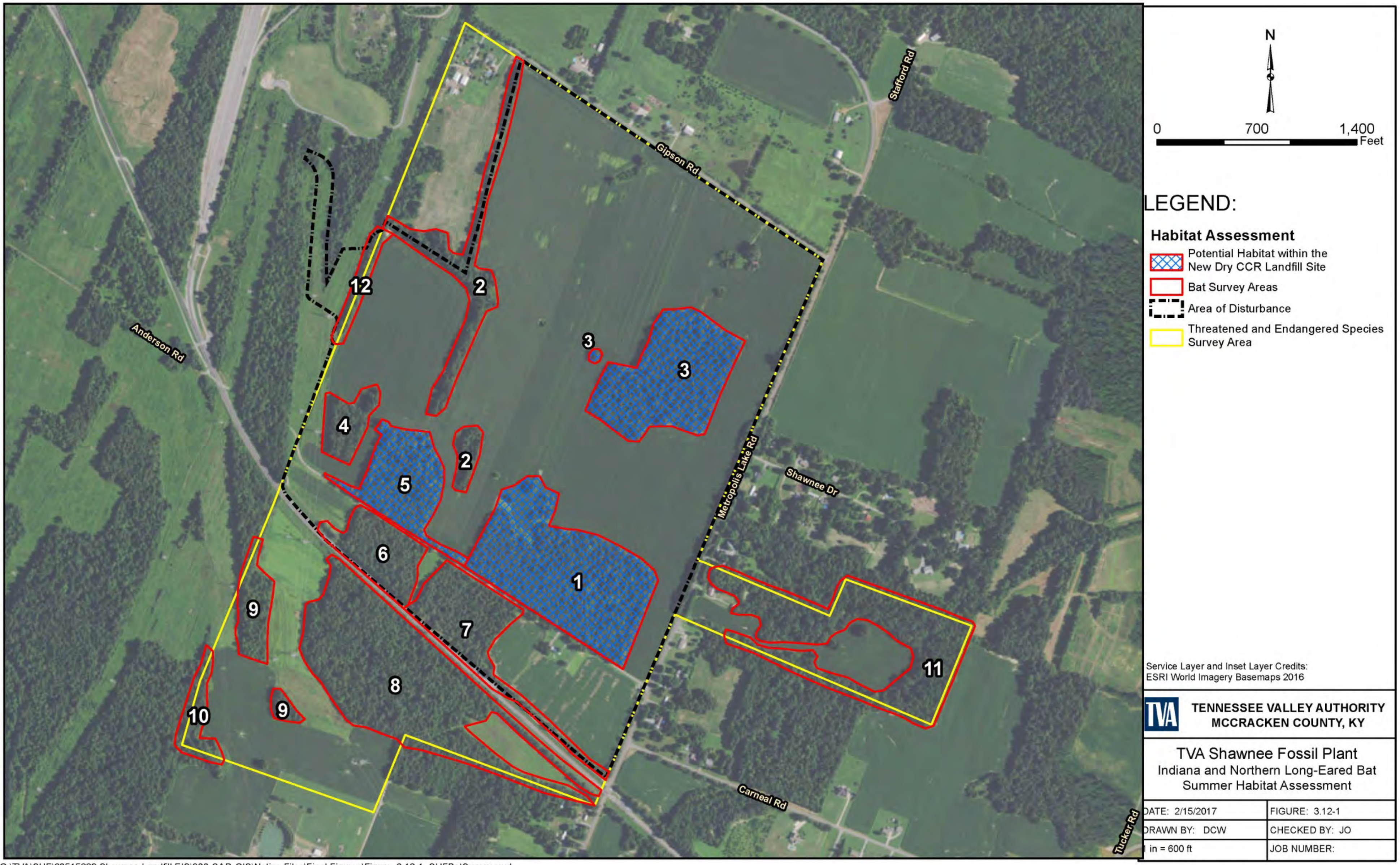
Attachments:

Figure 1 – TVA Shawnee Fossil Plant Indiana and Northern Long-eared Bat Summer Habitat Assessment Map

Attachment 1 - Photo Log - Indiana and Northern Long-eared Bat Phase I Summer Habitat Assessment

Attachment 2 - Appendix A - Indiana and Northern Long-eared Bat Phase I Summer Habitat Assessment Datasheet

Figure 1



G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Final Figures\Figure_3.12-1_SHFBatSurvey.mxd

Attachment 1

Photo Log – Indiana and Northern Long-eared Bat

Phase I Summer Habitat Assessment

AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No.	Date:	
1	11/1/16	
Direction Photo Taken: N		
Description: Abandoned barn on woodland edge in Area 1		

Photo No.	Date:	
2	11/1/16	
Direction Photo Taken: N		
Description: Small trees with multiple cracks/crevices in Area 1		

AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No. 3 **Date:** 11/1/16

Direction Photo Taken:

NW

Description:

Shagbark hickory and snag with crevices in Area 1

Photo No. 4 **Date:** 11/1/16

Direction Photo Taken:

NW

Description:

Exfoliating bark and crevice in Area 2

AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Paradise	Proposed landfill site	60515229

Photo No.	Date:
5	11/1/16

Direction Photo Taken:

NE

Description:

Large snag with cracks/crevices Area 2

Photo No.	Date:
6	11/1/16

Direction Photo Taken:

N

Description:

Tree with multiple crevices/hollows Area 2

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No. 7 **Date:** 11/1/16

Direction Photo Taken:

NE

Description:

Pond north of Area 3

Photo No. 8 **Date:** 11/1/16

Direction Photo Taken:

SE

Description:

Shagbark hickory with exfoliating bark in Area 3

AECOM		PHOTOGRAPHIC LOG
Client Name: TVA Shawnee	**Site Location:** Proposed landfill site	**Project No.** 60515229

Photo No. 9	**Date:** 11/1/16
Direction Photo Taken: SE	
Description: Shagbark hickories with exfoliating bark, Area 3	

Photo No. 10	**Date:** 11/1/16
Direction Photo Taken: NW	
Description: Large oak with cracks/crevices in Area 3	

AECOM		PHOTOGRAPHIC LOG
Client Name: TVA Shawnee	**Site Location:** Proposed landfill site	**Project No.** 60515229

Photo No. 11	**Date:** 11/1/16
Direction Photo Taken: NW	
Description: Shagbark hickory with exfoliating bark in Area 3	

Photo No. 12	**Date:** 11/1/16
Direction Photo Taken: E	
Description: Multiple Shagbark hickories and other trees with exfoliating bark and crevices in Area 3	

AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Paradise	Proposed landfill site	60515229

Photo No.	Date:
13	11/1/16

Direction Photo Taken:

SE

Description:

Shagbark hickories with exfoliating bark in Area 3

Photo No.	Date:
14	11/1/16

Direction Photo Taken:

NW

Description:

Shagbark hickory with exfoliating bark in Area 4

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Paradise	Proposed landfill site	60515229

Photo No.	Date:
15	11/1/16

Direction Photo Taken:

W

Description:

Large snag with multiple hollows/crevices in Area 4

Photo No.	Date:
16	11/1/16

Direction Photo Taken:

E

Description:

Mature tree with cracks/crevices in Area 5

AECOM		PHOTOGRAPHIC LOG
Client Name: TVA Paradise	**Site Location:** Proposed landfill site	**Project No.** 60515229

Photo No. 17 **Date:** 11/1/16

Direction Photo Taken:

E

Description:

Crevice and exfoliating bark in Shagbark Hickory in Area 5

Photo No. 18 **Date:** 11/1/16

Direction Photo Taken:

SE

Description:

Pond in Area 6

AECOM	**PHOTOGRAPHIC LOG**

Client Name:	**Site Location:**	**Project No.**
TVA Paradise	Proposed landfill site	60515229

Photo No. 19	**Date:** 11/2/16	
Direction Photo Taken: NE		
Description: Large snag with multiple cracks/crevices in Area 7		

Photo No. 20	**Date:** 11/2/16	
Direction Photo Taken: N		
Description: Multiple large snags with cracks/crevices/hollows in Area 8		

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Paradise	Proposed landfill site	60515229

Photo No.	Date:
21	11/2/16

Direction Photo Taken:

W

Description:

Tree with multiple cracks/crevices in Area 9

Photo No.	Date:
22	11/2/16

Direction Photo Taken:

SW

Description:

Pond in Area 9

AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Paradise	Proposed landfill site	60515229

Photo No. 23 **Date:** 11/2/16

Direction Photo Taken:

SE

Description:

Multiple black locust trees with cracks/crevices in Area 11

Photo No. 24 **Date:** 11/2/16

Direction Photo Taken:

SW

Description:

Pond in Area 11

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No. 25

Date: 2/4/17

Direction Photo Taken:

NW

Description:

Trees in Area 12 with transmission tower visible in the background near the center of the photo.

(Photo by Kevin Davenport, TVA)

Photo No. 26

Date: 2/4/17

Direction Photo Taken:

N

Description:

Trees in Area 12.

(Photo by Kevin Davenport, TVA)

Attachment 2

Appendix A – Indiana and Northern Long-eared Bat Phase I Summer Habitat Assessment Datasheet

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: TVA SHF Date: 11/1/2016 - 11/2/2016

Township/Range/Section: West Paducah

Lat Long/UTM/ Zone: 37.131764, -88.766316 Surveyor: JO, HO, DW

Brief Project Description

Bat Habitat survey for future proposed landfill site and associated facilities.

Project Area

	Total Acres	Forest Acres	Open Acres
Project	230	66.4	163.6
	Completely cleared	Partially cleared (will leave trees)	Preserve acres- no clearing
Proposed Tree Removal (ac)	66.4	0	0

Vegetation Cover Types

Pre-Project	Post-Project
Hardwood forest, pasture land and old field.	Landfill, grass cover, ponds, some facilities.

Landscape within 5 mile radius

Flight corridors to other forested areas?

Yes, Ohio River and streams are within 5 miles.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residencial development, water sources)

The area includes agricultural lands, forest, and resident development. The Ohio River is 1 mile north, Metropolis Lake is 0.5 mile north, Little Bayou Creek is 1 mile west.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

The Western Kentucky WMA is located 2 miles to the SSW.

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

<u>Use additional sheets to assess discrete habitat types at multiple sites in a project area</u>
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): 1
SE side of proposed landfill.

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral: None	Intermittent: None	Perennial: None	Describe existing condition of water sources: Water is very low. The pond is only open water choked with algae
Pools/Ponds (# and size)	1 = 0.2 ac	Open and accessible to bats? Yes		
Wetlands (approx. ac.)	Permanent: 2-3 ac	Seasonal: –		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	5	3	1	
Dominant Species of Mature Trees	red oak, shagbark hickory, mockernut hickory, silver maple, black cherry, white oak			
% Trees w/ Exfoliating Bark	10	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	60	25	15	
No. of Suitable Snags		5		

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes

Additional Comments:

There are many snags and crags, a total of 40 suitable roost trees with exfoliating bark.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

<u>Use additional sheets to assess discrete habitat types at multiple sites in a project area</u>

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): 2
Consists of two areas NW of proposed landfill

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral: 1 - 100 ft	Intermittent: –	Perennial: –	Describe existing condition of water sources: Wetland, open water only after rain.
Pools/Ponds (# and size)	1 = 0.1 ac	Open and accessible to bats? Yes		
Wetlands (approx. ac.)	Permanent: 1.5	Seasonal: –		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	4	2	5	
Dominant Species of Mature Trees	red oak, silver maple, hackberry			
% Trees w/ Exfoliating Bark	2	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	40	40	20	
No. of Suitable Snags		2		

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No

Additional Comments:

This site is a combination of two fence rows and a forested depression in an agricultural field. The tree lines are thin with very few snags.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

<u>Use additional sheets to assess discrete habitat types at multiple sites in a project area</u>

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): 3
NE portion of proposed landfill area.

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
	None	None	None	1 small farm pond. Wetlands are depressions within the forest.
Pools/Ponds (# and size)	1 = 0.1 ac	Open and accessible to bats?		
		Yes		
Wetlands (approx. ac.)	Permanent	Seasonal		
	2	–		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	3	2	1	
Dominant Species of Mature Trees	shagbark hickory, southern red oak, red maple, mockernut hickory, American elm, black cherry, ash			
% Trees w/ Exfoliating Bark	30	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	50	30	20	
No. of Suitable Snags	18			

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes

Additional Comments:
This site has high density of shagbark hickory trees.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): 4
Area impacted by the ancillary facility west of proposed landfill

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral: None	Intermittent: None	Perennial: None	Describe existing condition of water sources: No standing water at this site - one small wetland depression.
Pools/Ponds (# and size)	0	Open and accessible to bats? Yes		
Wetlands (approx. ac.)	Permanent: 0.1	Seasonal: –		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	3	2	1	
Dominant Species of Mature Trees	red oak, hackberry, black cherry			
% Trees w/ Exfoliating Bark	5	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	50	30	20	
No. of Suitable Snags		2		

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? some low quality habitat

Additional Comments:

Low quality habitat. Wooded area bordered by agricultural fields.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees, water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): 5
Wood area in the proposed landfill footprint.

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
	None	None	None	Small wetland depressions, one with standing water.
Pools/Ponds (# and size)	1 - 0.1 ac	Open and accessible to bats?		
		–		
Wetlands (approx. ac.)	Permanent	Seasonal		
	0.2	–		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	3	2	1	
Dominant Species of Mature Trees	red oak, shagbark hickory, hackberry			
% Trees w/ Exfoliating Bark	20	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	50	30	20	
No. of Suitable Snags	1			

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes

Additional Comments:
Two depressions were the only water sources here and they were seasonal - no standing water. Bat habitat is present.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): 6
South of Area 5, south of Anderson Road

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral: None	Intermittent: None	Perennial: None	Describe existing condition of water sources: One small pond.
Pools/Ponds (# and size)	0	Open and accessible to bats? –		
Wetlands (approx. ac.)	Permanent: 0.3	Seasonal: –		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	2	2	2	
Dominant Species of Mature Trees	red oak, black cherry, mockernut hickory			
% Trees w/ Exfoliating Bark	5	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	45	35	20	
No. of Suitable Snags	0			

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Temporary roost in 2 trees

Additional Comments:
Bat habitat was very marginal.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): 7
East of Area 6, South of Anderson Road.

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
	None	None	None	
Pools/Ponds (# and size)	1 = 0.1 Ac	Open and accessible to bats?		One small pond. Emergent and forested wetlands.
		–		
Wetlands (approx. ac.)	Permanent	Seasonal		
	1 - 2	–		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	2	3	4	
Dominant Species of Mature Trees	red oak, black cherry.			
% Trees w/ Exfoliating Bark	20	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	45	35	20	
No. of Suitable Snags		2		

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? marginal

Additional Comments:
Large forested area with wetlands. A number of mature trees are present, but only two snags and with few shagbark hickories.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

<u>Use additional sheets to assess discrete habitat types at multiple sites in a project area</u>
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): 8

Large forested area south of Areas 7 and 6 and south of railroads.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral: None	Intermittent: None	Perennial: None	Describe existing condition of water sources: One pond is open, one is clogged with algae. This area has a lot of wetland.
Pools/Ponds (# and size)	2 = 0.1	Open and accessible to bats? yes		
Wetlands (approx. ac.)	Permanent: 9.5	Seasonal: –		

Forest Resources at Sample Site

Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	4	2	2	
Dominant Species of Mature Trees	southern red oak, river birch			
% Trees w/ Exfoliating Bark	5	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	40	30	
No. of Suitable Snags	45			

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes

Additional Comments:

Lots of wetlands and trails in woods.

This area will not be impacted by the project.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): 9
Two separate wood lots near transmission line separated by old fields.

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
	None	None	None	Small dug out pond.
Pools/Ponds (# and size)	1 = 0.1	Open and accessible to bats?		
		yes		
Wetlands (approx. ac.)	Permanent	Seasonal		
	1 - 2	–		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	4	3	2	
Dominant Species of Mature Trees	southern red oak, shagbark hickory			
% Trees w/ Exfoliating Bark	20	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	40	30	
No. of Suitable Snags		4		

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes

Additional Comments:

Off-road trail through the wooded area provides travel corridor.

This area will not be impacted by project.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): 10

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral: 1 - 200	Intermittent: None	Perennial: None	Describe existing condition of water sources: Small pond is water source for bats.
Pools/Ponds (# and size)	1 = 0.1	Open and accessible to bats? –		
Wetlands (approx. ac.)	Permanent: 1 - 2	Seasonal: –		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	3	1	2	
Dominant Species of Mature Trees	red oak, sycamore, silver maple.			
% Trees w/ Exfoliating Bark	5	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	30	40	
No. of Suitable Snags		7		

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes

Additional Comments:
This area will not be impacted by project.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): 11
Property east of Metropolis Lake Road.

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral: 2 - WWC's	Intermittent: 1 - 750	Perennial: 1 - 2400	Describe existing condition of water sources: Intermittent streams with deep banks 10ft or more. stock pond.
Pools/Ponds (# and size)	1 = 0.3 ac	Open and accessible to bats? Yes		
Wetlands (approx. ac.)	Permanent: 0.5 - 1	Seasonal: --		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	2	4	5	
Dominant Species of Mature Trees	southern red oak			
% Trees w/ Exfoliating Bark	<5	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	60	30	10	
No. of Suitable Snags	19			

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes

Additional Comments:

Buffer area east of proposed landfill.

Not impacted by project.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Appendix D – Wetland Delineation Report

Appendix D –Wetland Delineation Report

F I N A L R E P O R T

WETLAND SURVEY
SHAWNEE FOSSIL PLANT (SHF)
MCCRACKEN COUNTY, KY

November 2016

AECOM

1000 Corporate Centre Drive
Suite 250
Franklin, Tennessee 37067
(615) 771-2480

TABLE OF CONTENTS

TABLES:

FIGURES:

ATTACHMENTS:

Introduction

AECOM was contracted by the Tennessee Valley Authority (TVA) to conduct a wetlands survey of two tracts of land, one located on the Shawnee Fossil Plant (SHF) facility, and the other located southeast of the SHF facility (Figure 1). The survey on the SHF was conducted within the boundaries of the SHF original ash pond 2 and special waste landfill areas (Figure 2). The survey to the southeast was conducted within the proposed location of the future bottom ash landfill (Figure 3). This location is referred to as the proposed landfill site, which is currently in agricultural land and hardwood forest and supports no commercial activity. The sites occupy a total of approximately 826 acres: 496 acres within the SHF facility and 330 acres within the proposed landfill site.
The SHF facility is bordered to the east by the main coal pile and powerhouse facility, to the north by the Ohio River, to the west by a large forested area, and to the south by forested land owned by SHF. All of the project study area within the SHF facility has been previously disturbed and is occupied by landfill, ponds, or facilities. Drainage on the facility generally flows to the northeast toward the ash ponds and south to Little Bayou Creek. The 100-year flood elevation is 337 feet above mean sea level (ft msl). None of the SHF property is designated as being within the 100-year floodplain (Figure 4).

The proposed landfill site property is bordered to the east by Metropolis Lake Road, to the north by Gibson Road and residential property, to the west by a transmission line right-of-way and TVA property, and to the south by a residential property on Metropolis Lake Road. The majority of the area has been previously disturbed by farming. The agricultural land was not cultivated in 2016 and has grown up in weeds and grass that is mowed. Drainage on the property flows generally to the west and south to Little Bayou Creek. The eastern and northern sides of the property drain east to an unnamed tributary of the Ohio River. The 100-year flood elevation is 337 ft msl. None of the proposed landfill site property is designated as being within the 100-year floodplain associated with any watershed (Figure 5).

Topographic maps, aerial photographs, soil maps, and other information were reviewed to determine the potential for each site to include wetlands, streams, and other water bodies. The historic use of each property was reviewed to determine the potential for past activities to have influenced site conditions. The proposed landfill property has been in agricultural use for decades, and a number of small ponds had been excavated on the property for prior farm use. The SHF facility has been in industrial and mining use for decades.

Following review of the available literature, a wetlands delineation and stream characterization was performed in accordance with the procedures outlined in the United States Army Corps of Engineers (USACE) Wetlands Delineation Manual (USACE 1987) and the Regional Supplement to the Manual for the Atlantic and Gulf Coastal Plain Region (USACE 2010). The delineation included visual observation of the site and characterization of the vegetation, soils, and hydrology to determine if various wetland criteria (hydric characteristics) were met.

The National Resource Conservation Service (NRCS) website was utilized to determine the soil types present on each site as a potential indicator of hydric soils and wetlands (Figures 6 and 7). Portions of the proposed landfill site were designated as hydric soils, but no soils on the SHF facility were designated as hydric because the entire area was previously disturbed.

The potential for wetlands was initially assessed by viewing the United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps for the SHF facility and the proposed landfill site, shown on Figures 8 and 9, respectively (USFWS 2016). Following a review of these data, wetland delineations were conducted on October 4 and November 1-2, 2016. Both delineations were led by Mr. James R. Orr, senior biologist and certified wetland delineator with AECOM. Mr. James Orr served as senior biologist for the delineations and has over 25 years of experience with wetlands delineation. Mr. Daniel Wade (environmental scientist), Mr. Hayden Orr (environmental engineer), and Ms. Sarah Davis (biologist) assisted with the surveys.

These data plus the site inspection were utilized to make determinations regarding the presence of wetlands on each site and their potential jurisdictional status. In implementing Section 404 of the Clean Water Act, the USACE has jurisdiction over "waters of the United States" (WOUS) (EPA 1972). Wetlands and water bodies that meet the criteria to be WOUS are "jurisdictional." The jurisdictional status of the wetlands and water bodies on each site was estimated based on their characteristics and whether they were considered likely to be considered WOUS by the USACE. The estimates of jurisdictional status are summarized in Table 1.

Literature Review

Wetlands

NWI maps for each site were downloaded from the USFWS NWI website (Figures 8 and 9) (USFWS 2016). The NWI map indicated a number of areas identified as open water wetland areas (palustrine unconsolidated bottom [PUB] or pond) on the proposed landfill property. One forested wetland was identified within the landfill project area. However, after field studies were conducted, it was determined that the proposed landfill site has many more small wetlands than are indicated on the NWI map.

According to the NWI map for the SHF facility, the entire area is designated as lacustrine (lake). Because the site has been heavily disturbed and industrialized, the wetlands map was modified based on the field studies (Figure 8). Multiple industrial ponds were identified, but no wetland areas were identified on the SHF facility property.

Drainage on the proposed landfill property and the SHF facility has been modified over the years. Natural drainages on the proposed landfill property flow to Little Bayou Creek or to an unnamed tributary of the Ohio River. Natural drainages on the SHF facility flow to the Ohio River or to Little Bayou Creek.

Soils

The soils survey for each site from the NRCS Web Soil Survey was reviewed (WSS 2016). All of the soils in the SHF facility are designated as Miscellaneous Water or Dumps (coal and waste disposal areas (Figure 6). The majority of the soils in the proposed landfill site are of four types: Calloway silt loam (0 to 2 percent slopes), Calloway silt loam (2 to 4 percent slopes, eroded), Routon silt loam (0 to 2 percent slopes), and Grenada silt loam (4 to 6 percent slopes, severely eroded) (Figure 7). Routon silt loam has a high percentage (87%) of hydric characteristics and is located in the southwestern and northern portions of the proposed landfill site. These soils have very slow infiltration rates, are clayey, have a high water table, and are shallow to an impervious layer.

In the field, soils were determined to be either hydric or non-hydric by the methods provided in the USACE 1987 Wetlands Delineation Manual and Atlantic and Gulf Coastal Plain Regional Supplement. During the survey, soil cores were collected and compared to the Munsell color chart. In addition, hydric characteristics were documented as listed in the Atlantic and Gulf Coastal Plain Region data sheets.

Hydrology

Wetland hydrology at each site was determined by the hydrologic characteristics of the site and site mapping (USGS 2015). Consideration was given to human impacts such as farming, industrial practices, construction, and grading. The major hydrologic features include drainages to Little Bayou Creek, the unnamed tributary to the east, isolated wetlands, forested wetlands, and ponds.

Methods

The wetlands determination was performed in accordance with the procedures outlined in the USACE Wetlands Delineation Manual (USACE 1987) as well as the Atlantic and Gulf Coastal Plain Regional Supplement (USACE 2010). Data were collected to characterize wetland areas in terms of hydrology, soils, dominant plant species, and wetland type using the USACE Wetland Determination Data Forms provided in the Regional Supplement. The completed forms for the wetlands on the proposed landfill site are included in Attachment 1. In addition, the value of each wetland was scored by using the TVA Rapid Assessment Method (TVARAM) to assess wetland condition, functional capacity, and quality (Mack 2001). The TVARAM field forms are provided in Attachment 1. Wetland boundaries were determined and recorded in the field, with GIS files generated for each wetland area.

Various types of open-water wetlands were preliminarily identified on the proposed landfill site by the NWI map. However, these were related to historic use and had been recently modified such that the study area did not have many of these water bodies present. The entire site was then walked to determine if wetlands were present, particularly along drainage pathways. On the proposed landfill site (330 acres), a total of

19 wetland areas were delineated. These included former farm ponds, isolated wetlands, forested wetlands, and drainage ways.

Wetland determination methods utilizing a shovel or corer were conducted to test soil conditions by comparison of site soils to the Munsell color chart. The soil color and other characteristics, such as depleted matrix and gleyed soils, were observed to determine the potential for hydric conditions. Soil cores were taken to a depth of up to 12 inches where needed. In addition, vegetation type and status were investigated to determine if wetland or upland plant species dominated. The dominant vegetation was documented, and percent cover was estimated. The wetland status of the vegetation was then determined from the United States Department of Agriculture (USDA) Plants Database (USDA 2016).

The final characteristic that was evaluated was the hydrology. The hydrologic characteristics were evaluated by estimating the frequency and level of saturation of the area and by documenting the primary and secondary hydrological characteristics as indicated on USACE Wetland Determination Data Forms (Attachment 1). Wetland boundary locations were documented on a site map and with GPS, and no flagging was left on the site. Photographs were taken of wetlands and adjoining non-wetland areas. USACE Data Forms were completed for both the wetland and upland areas. Wetland areas delineated on the SHF facility site and the proposed landfill site are summarized in Figures 8 and 9, respectively. A photolog of the wetland locations is provided in Attachment 2.

Field Survey

Based on the results of the literature review, one natural wetland and numerous ponds were historically associated with the proposed landfill site. During the weeks prior to the field surveys, very little rainfall had occurred. During the survey, no rain fell. Wetlands were identified in the field by the designation “W-1.” Nineteen wetland areas totaling 22.4 acres were identified on the proposed landfill site. The area and description of these wetlands are summarized in Table 1. The assumed jurisdictional status of these wetlands is indicated in Table 1; however, confirmation with the Louisville District of the USACE is advised.

Conclusions

Based on the review of literature and maps of the SHF facility site and the proposed landfill site, wetlands are potentially present on the proposed landfill site. Field review revealed that a total of 22.4 acres of wetlands is present in the 330-acre proposed landfill site. Within the 200-acre footprint of the proposed landfill itself, only 4.13 acres of wetlands are present. Of these 4.13 acres, it is estimated that 1.37 acres in two wetland areas may be designated as WOUS, while 2.76 acres in ten small, isolated areas are not WOUS. Of the total 22.4 acres of wetlands, approximately 20.7 acres are potentially WOUS due to drainages or drainage patterns that connect these wetlands to other waters, such as Little Bayou Creek.

All of the linear features (linear wetlands and streams) are jurisdictional WOUS because they are connected to other WOUS. Confirmation of the jurisdictional status could be requested by the Louisville District of the USACE.

Table 1

Wetland ID*	Wetland Type	Area/Length	Potential Jurisdictional Status
PUB-1	Pond	0.11 acre	Not WOUS, isolated farm pond
PUB-2	Pond	0.10 acre	Not WOUS, isolated farm pond
PUB-3	Pond	0.06 acre	Not WOUS, isolated farm pond
PUB-4	Pond	0.14 acre	Not WOUS, isolated farm pond
PUB-5	Pond	0.06 acre	Not WOUS, isolated farm pond
PUB-6	Pond	0.04 acre	Potential WOUS, connection to W-16
PUB-7	Pond	0.06 acre	Potential WOUS, connection to W-13
PUB-8	Pond	0.08 acre	Not WOUS isolated farm pond
PUB-9	Pond	15.31 acres	Not WOUS, ash pond
PUB-10	Pond	24.91 acres	Not WOUS, ash pond
PUB-11	Pond	1.75 acres	Not WOUS, ash pond
PUB-12	Pond	4.29 acres	Not WOUS, ash pond
PUB-13	Pond	0.75 acre	Not WOUS, ash pond
W-1	PFO	0.11 acre	Isolated, not WOUS
W-2	PFO	0.01 acre	Isolated, not WOUS
W-3	PFO	0.05 acre	Isolated not WOUS
W-4	PFO	0.16 acre	Isolated not WOUS
W-5	PFO	0.04 acre	Isolated not WOUS
W-6	PFO	0.29 acre	Isolated not WOUS
W-7-1	PFO	0.05 acre	Isolated not WOUS
W-7-2	PFO	0.37 acre	Isolated not WOUS
W-7-3	PFO	0.79 acre	Isolated not WOUS
W-8	PFO/PUB	0.26 acre	Isolated not WOUS
W-9	PFO	0.70 acre	WOUS connected to drainage
W-10	PFO	0.02 acre	Isolated not WOUS
W-11	PFO	0.11 acre	Isolated not WOUS
W-12	PFO	0.13 acre	Isolated not WOUS
W-13	PEM/PFO	4.31 acres	Potential WOUS, connection to drainage to Little Bayou Creek
W-14	PEM/PFO	1.49 acres	Potential WOUS, connection to drainage to Little Bayou Creek
W-15	PFO	1.74 acres	Potential WOUS, connection to

Wetland ID*	Wetland Type	Area/Length	Potential Jurisdictional Status
			drainage to Little Bayou Creek
W-16	PEM/PFO/PUB	13.55 (10.25) acres	Potential WOUS, connection to drainage to Little Bayou Creek (4 acres outside of property boundary)
W-17	PEM/PFO	0.97 acre	WOUS, connected to STR-2
W-18	PFO	0.67 acre	Potential WOUS connected to drainage to W-9
W-19	PFO/PUB	0.58 acre	Potential WOUS, connection to drainage to Little Bayou Creek
STR-1	Stream	749 feet	WOUS, connected to NWI stream
STR-2	Stream	2,402.4 feet	WOUS, connected to NWI stream
LW-1	Linear Wetland	300.2 feet	WOUS, connected to STR-2
WWC-1	Wet Weather Conveyance	573.9 feet	WOUS, connected to STR-1
WWC-2	Wet Weather Conveyance	305.5 feet	WOUS, connected to STR-1

*** Note: All of the features listed are within the proposed landfill site except for the five ash ponds (PUB-9, -10, -11, -12, and -13), which are on the SHF site.**

PFO – Palustrine forested wetland
PSS – Palustrine shrub scrub
PEM – Palustrine emergent wetland
PUB – Palustrine unconsolidated bottom

References

Environmental Protection Agency (EPA). Clean Water Act, Section 404. 1972.

Mack, John J. 2001. Ohio Rapid Assessment Method for Wetlands, Manual for Using Version 5.0. Ohio EPA Technical Bulletin Wetland/2001-1-1. Ohio Environmental Protection Agency, Division of Surface Water, 401 Wetland Ecology Unit, Columbus, Ohio.

United States Army Corps of Engineers (USACE). 1987. Wetlands Delineation Manual. Environmental Laboratory (EL) of the U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi.

United States Army Corps of Engineers (USACE). 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain

Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-20. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

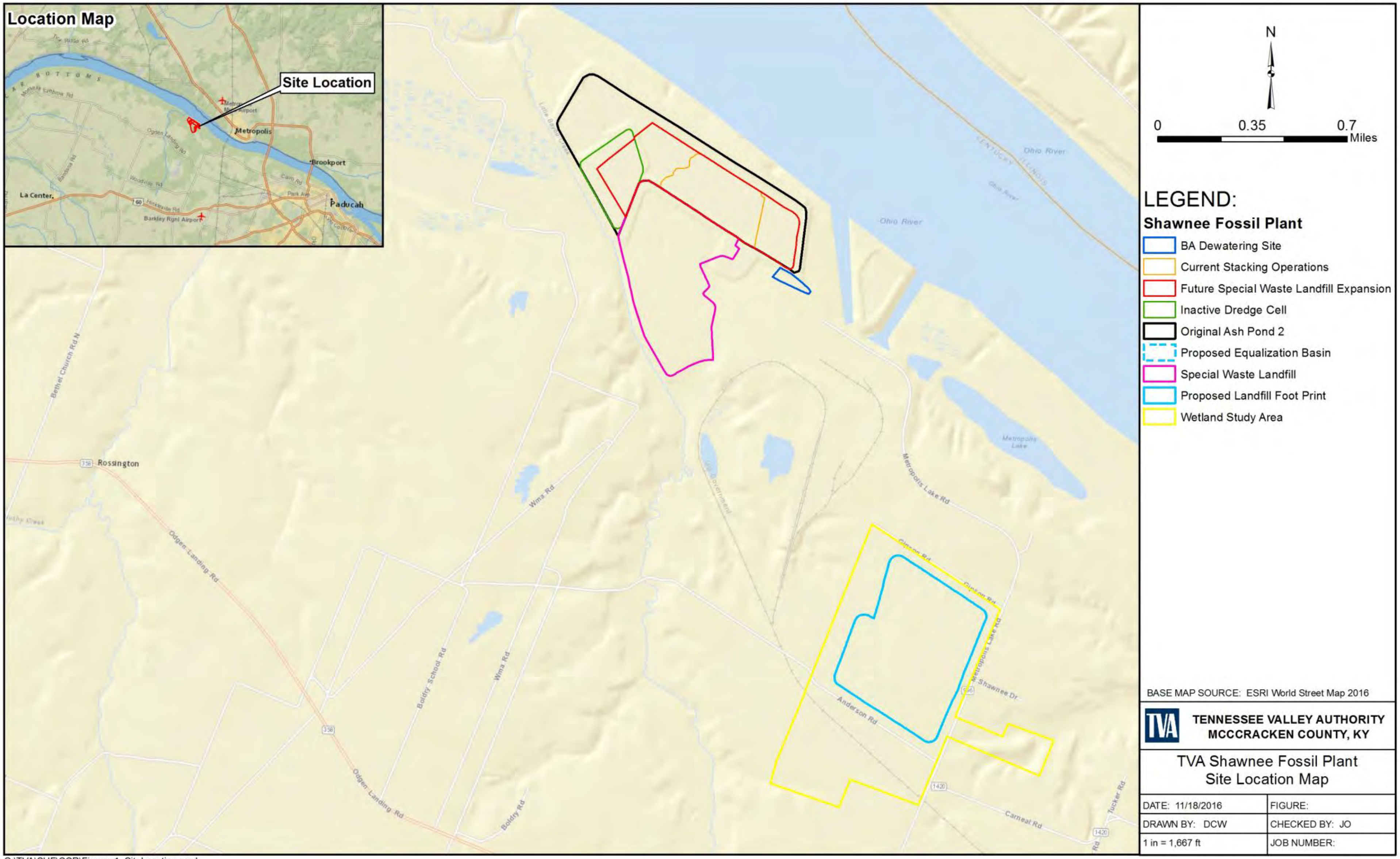
United States Department of Agriculture (USDA), Natural Resources Conservation Service. Plants Database. 2016. http://plants.usda.gov/java/. Accessed November 2016.

United States Department of Agriculture (USDA), Natural Resources Conservation Service. Web Soil Survey (WSS). 2016. http://websoilsurvey.sc.egov.usda.gov/. Accessed November 2016.

U.S. Fish and Wildlife Service (USFWS). National Wetlands Inventory (NWI). 2016. https://www.fws.gov/wetlands/Data/Mapper.html. Accessed November 2016.

U.S. Geological Survey (USGS), 20150717, USGS US Topo 7.5-minute map for Joppa, IL-KY 2015: USGS - National Geospatial Technical Operations Center (NGTOC)

Figures



G:\TVA\SHF\CCR\Figure_1_SiteLocation.mxd

Figure 1 – Site Location

Figure 2 – Shawnee Fossil Plant Site Vicinity

Figure 3 – Proposed Landfill Site Vicinity

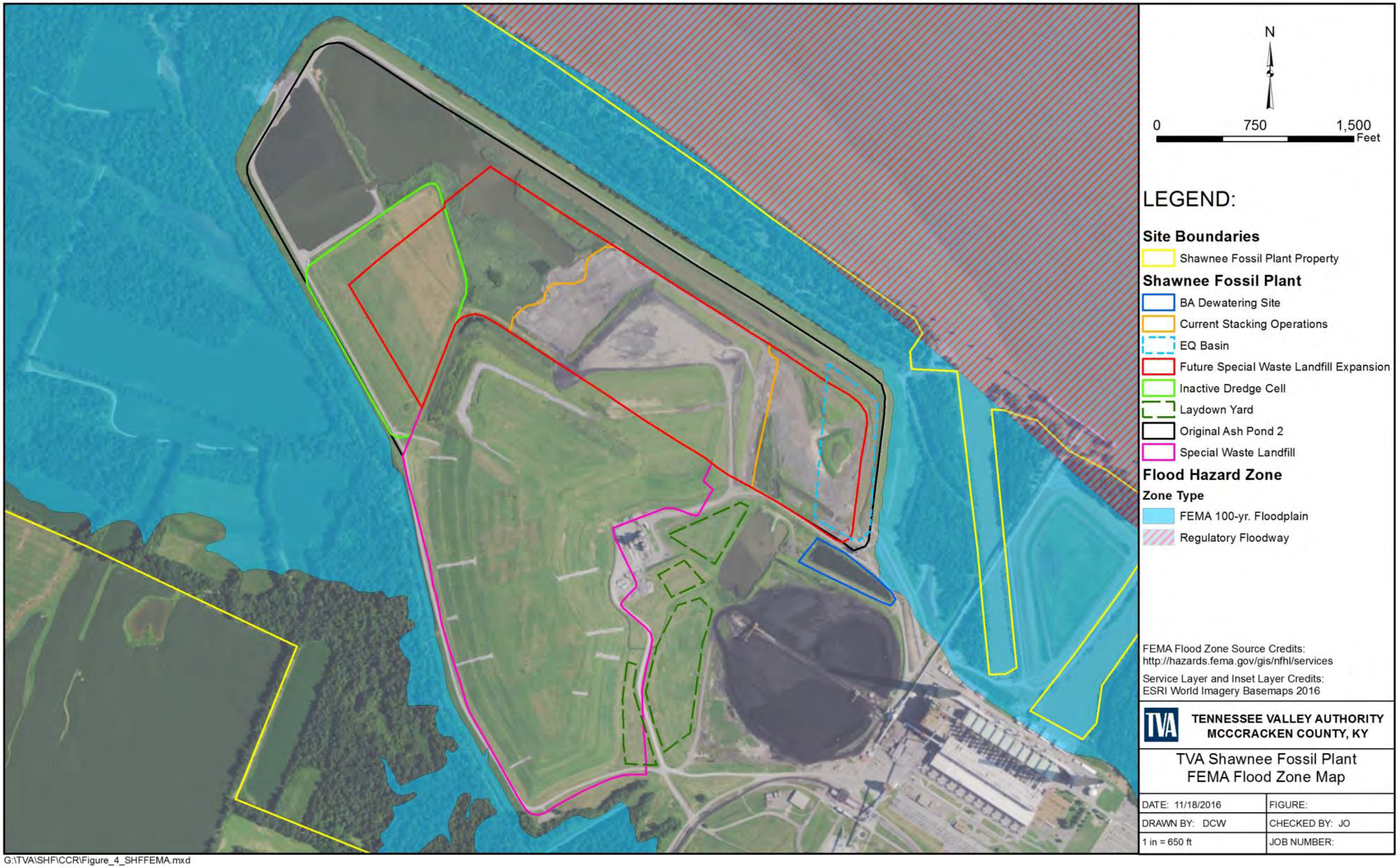


Figure 4 – Shawnee Fossil Plant FEMA 100-yr. Floodplain Map

Figure 5 – Proposed Landfill FEMA 100-yr. Floodplain Map

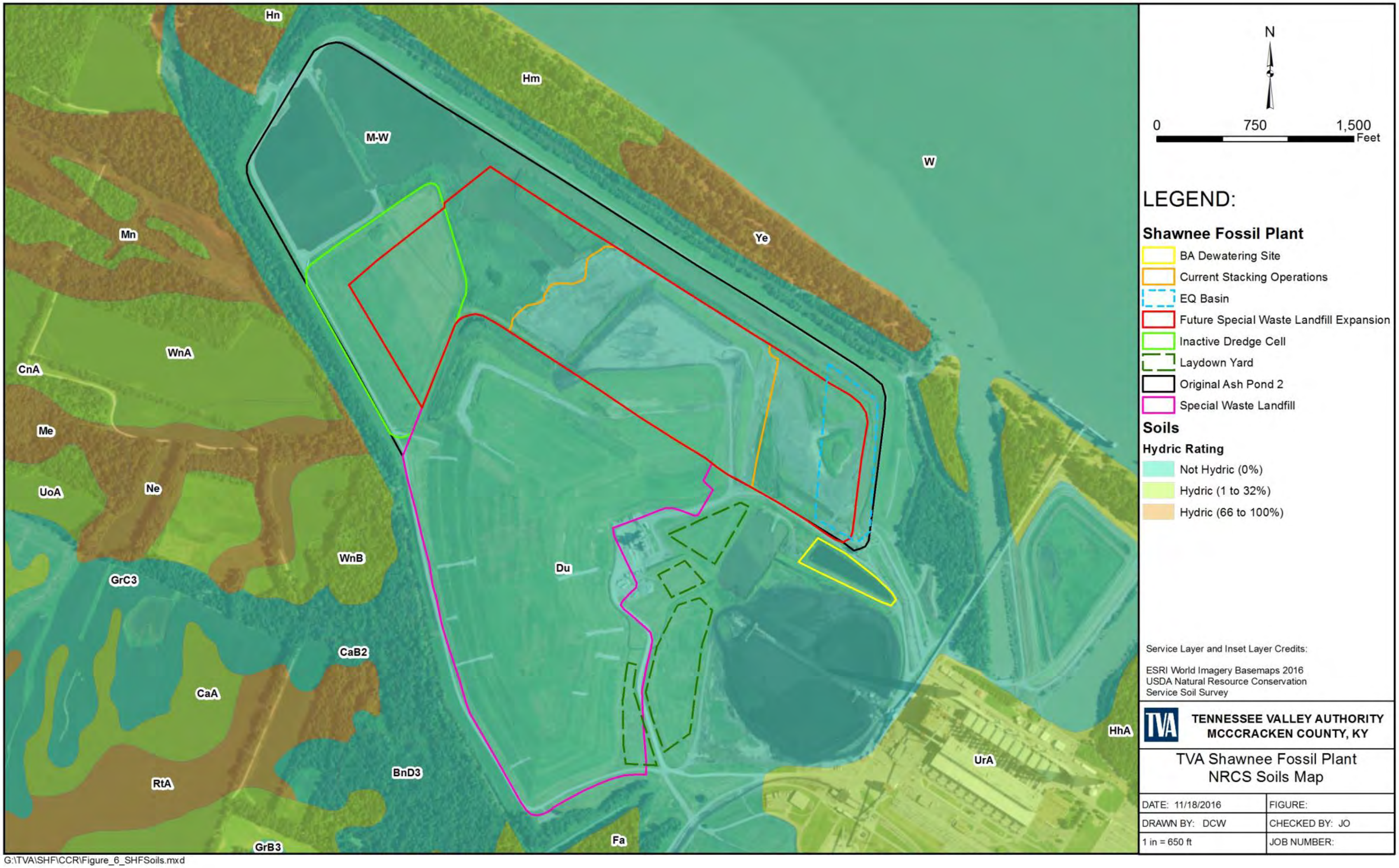


Figure 6 – Shawnee Fossil Plant NRCS Soils Map

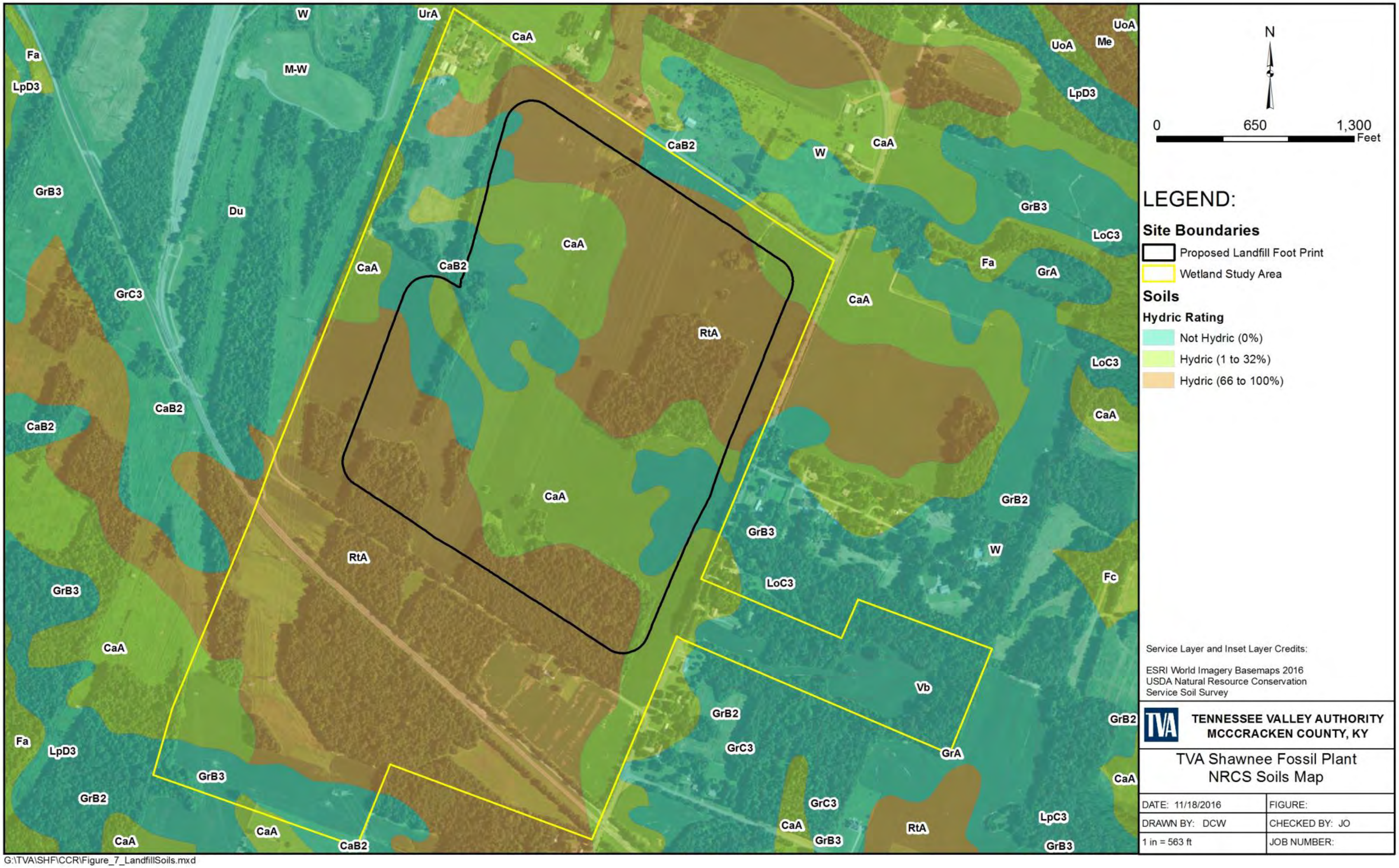
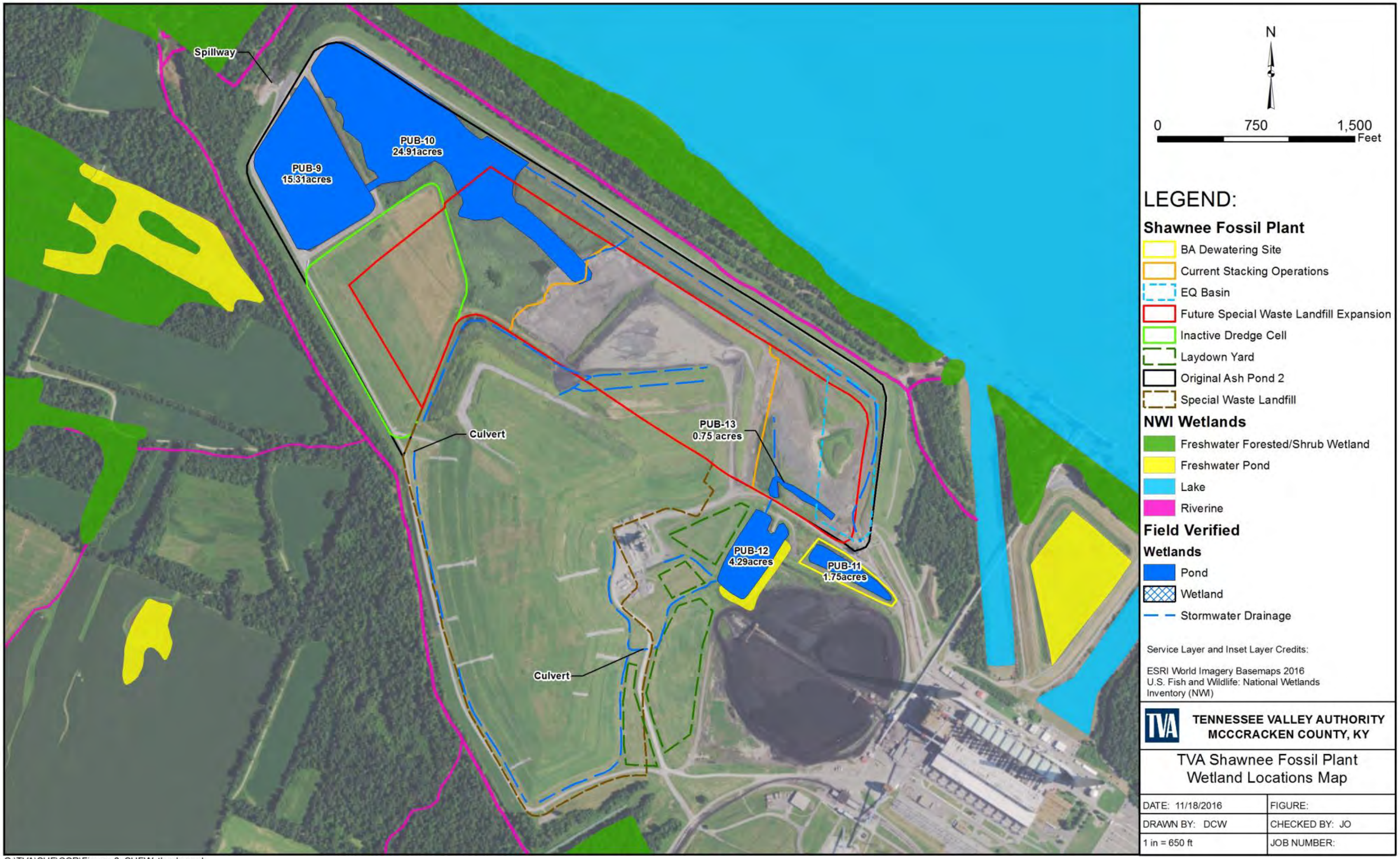
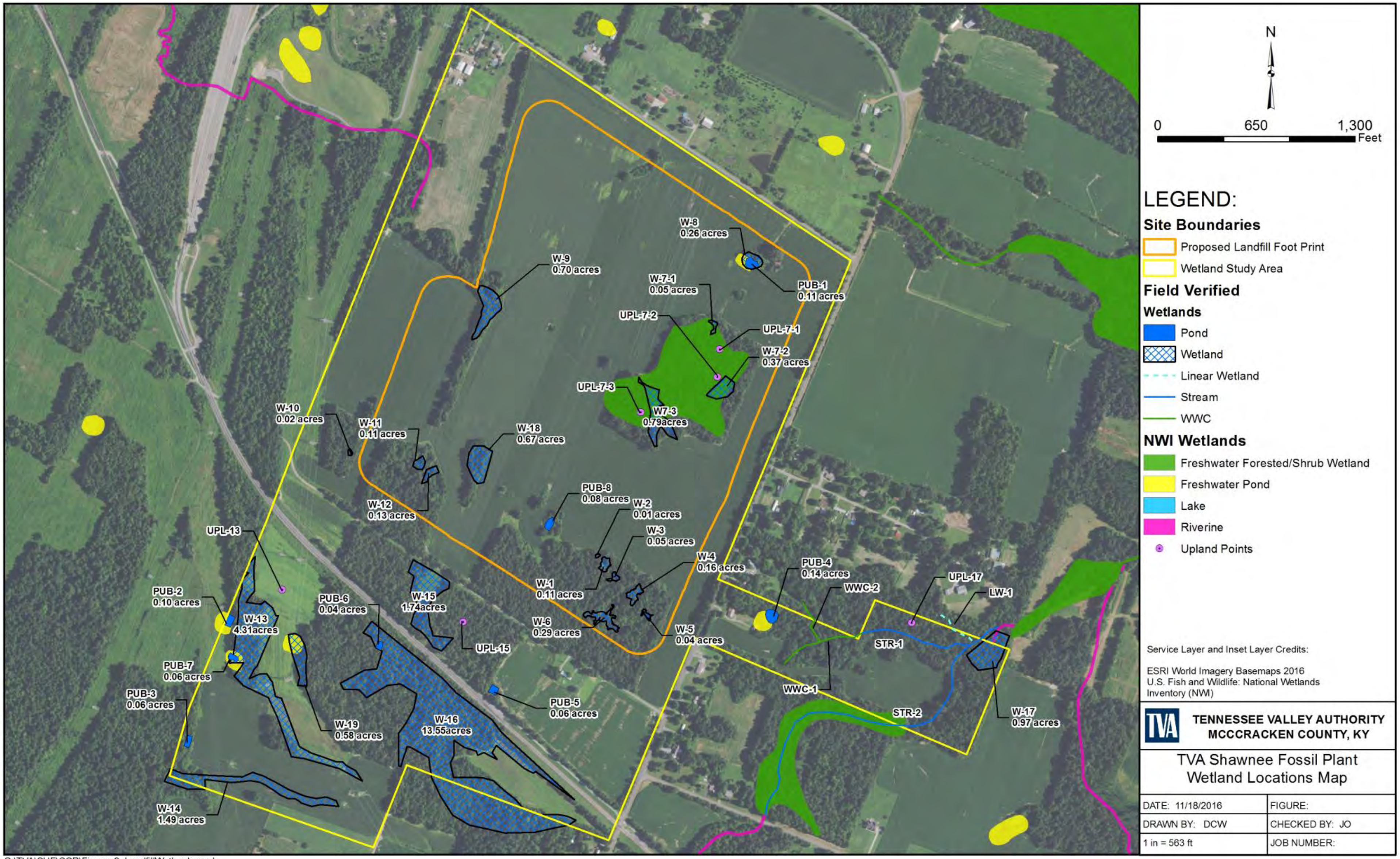


Figure 7 – Proposed Landfill NRCS Soils Map



G:\TVA\SHF\CCR\Figure_8_SHFWetlands.mxd

Figure 8 – Shawnee Fossil Plant USFWS NWI and Site Wetlands Map



G:\TVA\SHF\CCR\Figure_9_LandfillWetlands.mxd

Figure 9 – Proposed Landfill USFWS NWI and Site Wetlands Map

Attachment 1
Field Data Forms

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD1 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: W7-1 Up

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.138 Long: -88.769 Datum: NAD83

Soil Map Unit Name: Routon silt loam 2-4% slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	**Is the Sampled Area within a Wetland?**	**Yes** ___ **No** X
Hydric Soil Present?	Yes ___ No ___		
Wetland Hydrology Present?	Yes ___ No x		

Remarks:

all soils in area W-7 have some wetland inclusions. most areas do not support wetland vegetation or indicate wetland hydrology.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___	
Water Table Present?	Yes ___	No X	Depth (inches): ___	
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___	**Wetland Hydrology Present? Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey, NWI

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W7-1

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carya glabra	75	x	FACU
2. Carya ovata	15		FACU
3. Quercus rubra	10		FACU
4. Acer rubra	5		FACW
5. Prunus serotina	3		FACU
6. Diospyros virginiana	3		FAC
7. Viburnum prunifolium	3		FACU
8.			
	111 = Total Cover		
50% of total cover: 55.5	20% of total cover: 22.2		

Sapling/Shrub Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carya glabra	20	x	FACU
2. Zanthoxylum americanum	5		FAC
3. Rhus typhina	2		UPL
4. Rubus allegheniensis	10		UPL
5.			
6.			
7.			
8.			
	37 = Total Cover		
50% of total cover: 18.5	20% of total cover:		

Herb Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	54 = Total Cover		
50% of total cover: 27	20% of total cover:		

Woody Vine Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2. Campsis radicans	2		FAC
3. Lonicera japonica	10	x	FAC
4.			
5.			
	12 = Total Cover		
50% of total cover: 6	20% of 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: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ____ No x

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W7-1

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 7/3	100					silt loam	
3-9	10YR 6/3	100					silty clay	
9-12	10YR6/3	95	10YR6/8	5				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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** x

Remarks:

redox features very weak

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD1 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: W7-2 Up

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.137 Long: -88.770 Datum: NAD83

Soil Map Unit Name: Routon silt loam 2-4% slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** x
Hydric Soil Present?	Yes ___	No x	
Wetland Hydrology Present?	Yes ___	No x	

Remarks:

all soils in area W-7 have some wetland inclusions. most areas do not support wetland vegetation or indicate wetland hydrology.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes ___	No x	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No x	Depth (inches): ___

Wetland Hydrology Present? Yes ___ **No** x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey, NWI

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W7-2 up

Tree Stratum (Plot size: r = 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carya glabra	10		FACU
2. Carya ovata	30	x	FACU
3. Quercus rubra	10		FACU
4. Viburnum prunifolium	2		FACU
5. Ulmus alata	10		FACW
6. Fraxinus pennsylvanica	10		FACW
7. Prunus serotina	5		FACU
8.			
	77	= Total Cover	

50% of total cover: 38.5 20% of total cover: 15.4

Sapling/Shrub Stratum (Plot size: r = 30 ft)			
1. Carya glabra	20	x	FACU
2. Ulmus americana	10	x	FACW
3. Fraxinus pennsylvanica	5		FACW
4. Quercus rubra	5		FACU
5. Zanthoxylum americanum	5		FAC
6. Rosa multiflora	3		FACU
7.			
8.			
	48	= Total Cover	

50% of total cover: 24 20% of total cover: 9.6

Herb Stratum (Plot size: r = 30 ft)			
1. Persicaria pennsylvanicum	4		FACW
2. Rubus allegheniensis	10	x	UPL
3. Phytolacca americana	2		FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	16	= Total Cover	

50% of total cover: 8 20% of total cover: 3.2

Woody Vine Stratum (Plot size: r = 30 ft)			
1.			
2.			
3. Lonicera japonica	30	x	FAC
4. Toxicodendron radicans	30	x	FAC
5.			
	60	= Total Cover	

50% of total cover: 20% of 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: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	
FACW species	39	x 2 =	78
FAC species	65	x 3 =	195
FACU species	87	x 4 =	348
UPL species	10	x 5 =	50
Column Totals:	201 (A)		671 (B)

Prevalence Index = B/A = 3.34

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No x

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W7-2 up

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 6/3	100					silt loam	
5-6	10YR 6/4	95	10YR 7/4	5			silty loam	
7-12	10YR 7/3	95	10YR 7/4	5			silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 x

Remarks:
redox features very weak

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD1 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: W7-3 Up

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.136 Long: -88.772 Datum: NAD83

Soil Map Unit Name: Routon silt loam 2-4% slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	Is the Sampled Area within a Wetland?	Yes ___ No X
Hydric Soil Present?	Yes ___ No x		
Wetland Hydrology Present?	Yes ___ No x		

Remarks:

all soils in area W-7 have some wetland inclusions. most areas do not support wetland vegetation or indicate wetland hydrology.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches): ___		
Water Table Present?	Yes ___ No X	Depth (inches): ___		
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey, NWI

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W7-3 up

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carya glabra	25	x	FACU
2. Carya ovata	20	x	FACU
3. Quercus rubra	15		FACU
4. Viburnum prunifolium	10		FACU
5. Celtis occidentalis	5		FACU
6. Sassafras albidum	2		FACU
7.			
8. Ulmus alata	7		FACU
	84 = Total Cover		
50% of total cover: 42	20% of total cover: 16.8		

Sapling/Shrub Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Celtis occidentalis	10	x	FACU
2. Ulmus americana	3		FACW
3. Fraxinus sp.	3		?
4.			
5.			
6.			
7.			
8.			
	16 = Total Cover		
50% of total cover: 8	20% of total cover: 2		

Herb Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ageratina altissima	4		FACU
2. Verbesina virginica	4		FACU
3. Phytolacca americana	5		FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	13 = Total Cover		
50% of total cover: 6.5	20% of total cover: 2.6		

Woody Vine Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Celastrus orbiculatus	5		FACU
2. Campsis radicans	15	x	FAC
3. Lonicera japonica	20	x	FAC
4. Toxicodendron radicans	5		FAC
5.			
	45 = Total Cover		
50% of total cover: 22.5	20% of total cover: 9		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ____ No x

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W7-3 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 5/4	100					silt loam	
3-6	10YR 6/4	95	10YR 7/6	5			silty loam	
6-12	10YR 7/2	90	10YR 7/6	10			silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 x

Remarks:

redox features very weak

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD-2 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: UPL 13

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): agricultural field/ wooded Local relief (concave, convex, none): none Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.133 Long: -88.779 Datum: NAD83

Soil Map Unit Name: Routon silt loam 2-4% slopes NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes ___ No x	
Wetland Hydrology Present?	Yes ___ No x	

Remarks:

Area was used as corn field in the past, corn stubble present.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

Wetland Hydrology Present? Yes ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: UPL 13

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: r =)			
1. Sorghum halepense	60		FACU
2. Andropogon virginicus	40		FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100 = Total Cover		
50% of total cover:	20% of total cover:		
Woody Vine Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ____ **No** x

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: UPL 13

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
0-12	10YR 6/4	100					silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 x

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD-14 City/County: Paducah, McCracken County Sampling Date: 10/4/16

Applicant/Owner: TVA State: KY Sampling Point: UPL 15

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): flat woods and open field Local relief (concave, convex, none): none Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.132 Long: -88.775 Datum: NAD83

Soil Map Unit Name: Routon silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** x
Hydric Soil Present?	Yes ___	No x	
Wetland Hydrology Present?	Yes ___	No x	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___
Water Table Present?	Yes ___	No x	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No x	Depth (inches): ___

Wetland Hydrology Present? Yes ___ **No** x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Area to the east and west of KSPPD14-2 and north of RR.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: UPL-15

Tree Stratum (Plot size: 30ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus alba	5		FACU
2. Quercus rubra	20		FACU
3. Ulmus americana	10		FACW
4. Carya tomentosa	30	y	FACU
5. Prunus serotina	10		FACU
6. Quercus stellata	10		UPL
7.			
8.			
	85	= Total Cover	

50% of total cover: ______ 20% of total cover: ______

Sapling/Shrub Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carya tomentosa	50	y	FACU
2. Ulmus americana	5		FACW
3. Liquidambar atyraciflua	5		FACW
4. Zanthoxylum americanum	10		FACU
5.			
6.			
7.			
8.			
		= Total Cover	

50% of total cover: ______ 20% of total cover: ______

Herb Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Toxicodendron radicans	5		FAC
2. Ageratina altissima	5		UPL
3. Rubus allegheniensis	5		FACU
4. Lonicera japanica	10	y	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
		= Total Cover	

50% of total cover: ______ 20% of total cover: ______

Woody Vine Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Campsis radicans	5	y	FAC
2.			
3.			
4.			
5.			
		= Total Cover	

50% of total cover: ______ 20% of 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: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:	
OBL species		x 1 =	
FACW species	20	x 2 =	40
FAC species	20	x 3 =	60
FACU species	130	x 4 =	520
UPL species	15	x 5 =	75
Column Totals:	185 (A)		695 (B)

Prevalence Index = B/A = 3.76

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ______ **No** x

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: UPL-15

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
0-12	10YR 7/3	100					Silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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** x

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD-3 City/County: Paducah, McCracken County Sampling Date: 10/4/16

Applicant/Owner: TVA State: KY Sampling Point: UPL-17

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): agricultural field/wooded Local relief (concave, convex, none): none Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.130 Long: -88.764 Datum: NAD83

Soil Map Unit Name: Vicksburg silt loam NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	**Is the Sampled Area within a Wetland?**	**Yes** ___ **No** X
Hydric Soil Present?	Yes ___ No x		
Wetland Hydrology Present?	Yes ___ No x		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___ No X	Depth (inches): ___	
Water Table Present?	Yes ___ No X	Depth (inches): ___	
Saturation Present? (includes capillary fringe)	Yes ___ No X	Depth (inches): ___	**Wetland Hydrology Present? Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W17

Tree Stratum (Plot size: 30ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Robinia pseudoacacia	25	y	FACU
2. Celtis occidentalis	10		FACU
3. Ulmus americana	10		FACW
4. Acer rubrum	20	y	FACW
5. Liriodendron tulipifera	5		FACU
6. Acer negundo	20	y	FACW
7.			
8.			
	90 = Total Cover		
50% of total cover:	20% of total cover:		

Sapling/Shrub Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Rosa multiflora	5	y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Toxicodendron radicans	5		FAC
2. Persicaria pensylvanica	5		FACW
3. Rubus allegheniensis	15	y	FACU
4. Lonicera japanica	5		FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	35 = Total Cover		
50% of total cover:	20% of total cover:		

Woody Vine Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Campsis radicans	5	y	FAC
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of 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: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 = 0
FACW species	55	x 2 = 110
FAC species	15	x 3 = 45
FACU species	60	x 4 = 240
UPL species		x 5 =
Column Totals:	130 (A)	395 (B)

Prevalence Index = B/A = 3.04

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ____ **No** x

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W17

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
0-12	10YR 6/6	100					Silty Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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** x

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF City/County: Paducah, McCracken County Sampling Date: 11/2/16

Applicant/Owner: TVA State: KY Sampling Point: W1

Investigator(s): HO, DW Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 1-2

Subregion (LRR or MLRA): ______ Lat: 37.163517 Long: -88.793202 Datum: NAD83

Soil Map Unit Name: ______ NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology x significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x	No ____	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** ____
Hydric Soil Present?	Yes ____	No ____	
Wetland Hydrology Present?	Yes ____	No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

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 (Four Strata) – Use scientific names of plants. Sampling Point: W1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Populus deltoides	1		FAC
2. Liquidamber styraciflua	2		FAC
3. Platanus occidentalis	3		FACW
4. Celtis occidentalis	1		FACU
5. Robina pseudoacacia	1		FACU
6.			
7.			
8.			
	8	= Total Cover	
50% of total cover: 4	20% of total cover: 1.6		

Sapling/Shrub Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Elaeagnus umbellata	2		FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	2	= Total Cover	
50% of total cover: 1	20% of total cover: 0.4		

Herb Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Rubus alumuns	4		FACU
2. Arando donax	2		FACU
3. Phragmites australis	85	x	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	91	= Total Cover	
50% of total cover: 45.5	20% of total cover: 18.2		

Woody Vine Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
50% of total cover:	20% of 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	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	87	x 2 = 174
FAC species	5	x 3 = 15
FACU species	8	x 4 = 32
UPL species		x 5 =
Column Totals:	101 (A)	221 (B)

Prevalence Index = B/A = 2.18

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ______ **No** ______

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W1

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	GLEY 2 4/SPB	100				m	silt	coal ash pile runoff

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 – Atlantic and Gulf Coastal Plain Region

Project/Site: Shawnee FP-Landfill City/County: Paducah, McCracken County Sampling Date: 5/12/16

Applicant/Owner: TVA State: KY Sampling Point: W002

Investigator(s): David Nestor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 37 deg 7' 59.391"N Long: -88 deg 46' 19.158" Datum: NAD83

Soil Map Unit Name: ______ NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x	No ______	**Is the Sampled Area within a Wetland?** **Yes** x **No** ______
Hydric Soil Present?	Yes x	No ______	
Wetland Hydrology Present?	Yes x	No ______	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes x	No ______	Depth (inches): 4"
Water Table Present?	Yes x	No ______	Depth (inches): ______
Saturation Present? (includes capillary fringe)	Yes x	No ______	Depth (inches): ______

Wetland Hydrology Present? Yes x **No** ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey

Remarks:

Hydrology present. Water was 4 inches deep. It was also raining the day of the survey.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W002

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus lyrata?	50	x	OBL
2. Celtis laevigata	45		FACW
3.			
4.			
5.			
6.			
7.			
8.			
	95 = Total Cover		
50% of total cover: 48	20% of total cover: 19		
Sapling/Shrub Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Woody Vine Stratum (Plot size: r =)			
1. Parthenocissus quinquefolia	20	x	FACU
2. Toxicodendron radicans	20	x	FAC
3.			
4.			
5.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		

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: 67 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W002

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 5/2	10	10YR 5/8		C	M	Loamy/Clayey	
6-18	10YR 6/1	40	10YR 5/8	60	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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** X **No** ______

Remarks:

Hydric soils present. A hard layer, difficult to penetrate, was found at 6 inches.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Shawnee FP-Landfill City/County: Paducah, McCracken County Sampling Date: 5/12/16

Applicant/Owner: TVA State: KY Sampling Point: W003

Investigator(s): David Nestor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 37 deg 7' 58.034"N Long: -88 deg 46' 17.662" Datum: NAD83

Soil Map Unit Name: ______ NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ___

Hydric Soil Present? Yes x No ___

Wetland Hydrology Present? Yes x No ___

Is the Sampled Area within a Wetland? **Yes** x **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [x] 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)
- [ ] Marl Deposits (B15) **(LRR U)**
- [ ] 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)
- [x] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ______

Water Table Present? Yes ___ No x Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes x No ___ Depth (inches): ______

Wetland Hydrology Present? **Yes** x **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey

Remarks:

It was raining the day of the survey.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W003

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus rubra	50	x	FAC
2. Celtis laevigata	50	x	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		
Sapling/Shrub Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: r =)			
1. Microstegium vimineum	40	x	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		
Woody Vine Stratum (Plot size: r =)			
1. Parthenocissus quinquefolia	20	x	FACU
2. Toxicodendron radicans	10		FAC
3. Lonicera japonica	5		FACU
4. Celastrus orbiculatus	2		FACU
5.			
	37 = Total Cover		
50% of total cover: 18.5	20% of total cover: 7.4		

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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

☐ 1 - Rapid Test for Hydrophytic Vegetation
☐ 2 - Dominance Test is >50%
☐ 3 - Prevalence Index is ≤3.0[1]
☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No** ______

Remarks: (If observed, list morphological adaptations below).

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 %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 6/1	90	5YR 5/8	10	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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** x **No** ____

Remarks:

Hydric soils present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Shawnee FP-Landfill City/County: Paducah, McCracken County Sampling Date: 5/12/16

Applicant/Owner: TVA State: KY Sampling Point: W004

Investigator(s): David Nestor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 37 deg 7' 56.936"N Long: -88 deg 46' 16.083" Datum: NAD83

Soil Map Unit Name: ______ NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ____		**Is the Sampled Area within a Wetland?** **Yes** x **No** ____
Hydric Soil Present? Yes x No ____		
Wetland Hydrology Present? Yes x No ____		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ____ No x Depth (inches): ______

Water Table Present? Yes ____ No x Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes x No ____ Depth (inches): ______

Wetland Hydrology Present? Yes x **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey

Remarks:

It was raining the day of the survey.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W004

Tree Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus rubra	100	x	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover	100		

50% of total cover: 50 20% of total cover: 20

Sapling/Shrub Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover			

50% of total cover: 20% of total cover:

Herb Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	60	x	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
= Total Cover	60		

50% of total cover: 30 20% of total cover: 12

Woody Vine Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Campsis radicans	20	x	FAC
2. Parthenocissus quinquefolia	5		FACU
3. Toxicodendron radicans	2		FAC
4.			
5.			
= Total Cover	27		

50% of total cover: 13.5 20% of total cover: 5.4

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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

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
0-18	10YR 6/1	90	5YR 5/6	10	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 X No ______

Remarks:

Hydric soils present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Shawnee FP-Landfill City/County: Paducah, McCracken County Sampling Date: 5/12/16

Applicant/Owner: TVA State: KY Sampling Point: W005

Investigator(s): David Nestor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 37 deg 7' 55.646"N Long: -88 deg 46' 15.056" Datum: NAD83

Soil Map Unit Name: ______ NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ___	**Is the Sampled Area within a Wetland? Yes x No ___**
Hydric Soil Present?	Yes x No ___	
Wetland Hydrology Present?	Yes x No ___	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ______

Water Table Present? Yes ___ No x Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes x No ___ Depth (inches): ______

Wetland Hydrology Present? Yes x No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey

Remarks:

It was raining the day of the survey.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W005

Tree Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus rubra	75	x	FAC
2. Salix nigra	15		OBL
3. Celtis laevigata	10		FACW
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		

50% of total cover: 50 20% of total cover: 20

Sapling/Shrub Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

50% of total cover: 20% of total cover:

Herb Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60 = Total Cover		

50% of total cover: 30 20% of total cover: 12

Woody Vine Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Campsis radicans	15	x	FAC
2. Toxicodendron radicans	2		FAC
3.			
4.			
5.			
	17 = Total Cover		

50% of total cover: 8.5 20% of total cover: 3.4

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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

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 %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 6/1	90	5YR 5/6	10	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) **(LRR P, T, U)**
- [ ] 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- [ ] Muck Presence (A8) **(LRR U)**
- [ ] 1 cm Muck (A9) **(LRR P, T)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) **(MLRA 150A)**
- [ ] Sandy Mucky Mineral (S1) **(LRR O, S)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) **(LRR P, S, T, U)**
- [ ] Polyvalue Below Surface (S8) **(LRR S, T, U)**
- [ ] Thin Dark Surface (S9) **(LRR S, T, U)**
- [ ] Loamy Mucky Mineral (F1) **(LRR O)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) **(LRR U)**
- [ ] Depleted Ochric (F11) **(MLRA 151)**
- [ ] Iron-Manganese Masses (F12) **(LRR O, P, T)**
- [ ] Umbric Surface (F13) **(LRR P, T, U)**
- [ ] Delta Ochric (F17) **(MLRA 151)**
- [ ] Reduced Vertic (F18) **(MLRA 150A, 150B)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) **(LRR O)**
- [ ] 2 cm Muck (A10) **(LRR S)**
- [ ] Reduced Vertic (F18) **(outside MLRA 150A,B)**
- [ ] Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- [ ] Red Parent Material (TF2)
- [ ] 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** X **No** ______

Remarks:

Hydric soils present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Shawnee FP-Landfill City/County: Paducah, McCracken County Sampling Date: 5/12/16

Applicant/Owner: TVA State: KY Sampling Point: W006

Investigator(s): David Nestor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 37 deg 7' 55.432"N Long: -88 deg 46' 18.573" Datum: NAD83

Soil Map Unit Name: ______ NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ___	Is the Sampled Area within a Wetland?	Yes x No ___
Hydric Soil Present?	Yes x No ___		
Wetland Hydrology Present?	Yes x No ___		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___ No x	Depth (inches): ___	
Water Table Present?	Yes ___ No x	Depth (inches): ___	
Saturation Present? (includes capillary fringe)	Yes x No ___	Depth (inches): ___	**Wetland Hydrology Present? Yes x No ___**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: W006

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus rubra	90	x	FAC
2. Carya glabra	10		FACU
3.			
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		

Sapling/Shrub Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense	5	x	FAC
2. Symphoricarpos orbiculatus	1		FACU
3.			
4.			
5.			
6.			
7.			
8.			
	6 = Total Cover		
50% of total cover: 3	20% of total cover: 1.2		

Herb Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	80	x	FAC
2. Boehmeria cylindrica	2		FACW
3. Persicaria sp.	1		
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	83 = Total Cover		
50% of total cover: 41.5	20% of total cover: 16.6		

Woody Vine Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Parthenocissus quinquefolia	15	x	FACU
2.			
3.			
4.			
5.			
	1 = Total Cover		
50% of total cover: 7.5	20% of total cover: 3		

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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

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
0-18	10YR 6/1	90	5YR 5/6	10	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 X No ______

Remarks:
Hydric soils present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD1 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: W7-1

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.137 Long: -88.769 Datum: NAD83

Soil Map Unit Name: Routon silt loam 2-4% slopes NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ______	**Is the Sampled Area within a Wetland?** **Yes** x **No** ______
Hydric Soil Present?	Yes x No ______	
Wetland Hydrology Present?	Yes x No ______	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ______	No x	Depth (inches): ______	
Water Table Present?	Yes ______	No x	Depth (inches): ______	
Saturation Present? (includes capillary fringe)	Yes ______	No x	Depth (inches): ______	**Wetland Hydrology Present? Yes** x **No** ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey, NWI

Remarks:

NWI has area listed as PFO1A.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W7-1

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus palustris	60	x	FACW
2. Celtis laevigata	5		FACW
3. Carya glabra	1		FACU
4. Celtis occidentalis	5		FACU
5. Quercus rubra	1		FACU
6.			
7.			
8.			
	72 = Total Cover		
50% of total cover: 36	20% of total cover: 14.4		
Sapling/Shrub Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: r =)			
1. Urtica dioica	50	x	FACU
2. Persicaria pennsylvanicum	4		FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	54 = Total Cover		
50% of total cover: 27	20% of total cover:		
Woody Vine Stratum (Plot size: r =)			
1.			
2. Campsis radicans	50	x	FAC
3. Lonicera japonica	5		FAC
4.			
5.			
	55 = Total Cover		
50% of total cover: 27.5	20% of 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: 67 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W7-1

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 5/3	20	10YR6/1	60	C	M	silty clay	
			10YR6-6	20	C	M	silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) **(LRR P, T, U)**
- [ ] 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- [ ] Muck Presence (A8) **(LRR U)**
- [ ] 1 cm Muck (A9) **(LRR P, T)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) **(MLRA 150A)**
- [ ] Sandy Mucky Mineral (S1) **(LRR O, S)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) **(LRR P, S, T, U)**
- [ ] Polyvalue Below Surface (S8) **(LRR S, T, U)**
- [ ] Thin Dark Surface (S9) **(LRR S, T, U)**
- [ ] Loamy Mucky Mineral (F1) **(LRR O)**
- [x] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) **(LRR U)**
- [ ] Depleted Ochric (F11) **(MLRA 151)**
- [ ] Iron-Manganese Masses (F12) **(LRR O, P, T)**
- [ ] Umbric Surface (F13) **(LRR P, T, U)**
- [ ] Delta Ochric (F17) **(MLRA 151)**
- [ ] Reduced Vertic (F18) **(MLRA 150A, 150B)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) **(LRR O)**
- [ ] 2 cm Muck (A10) **(LRR S)**
- [ ] Reduced Vertic (F18) **(outside MLRA 150A,B)**
- [ ] Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- [ ] Red Parent Material (TF2)
- [ ] 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 X No ______

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD1 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: W7-2

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.136 Long: -88.770 Datum: NAD83

Soil Map Unit Name: Routon silt loam 2-4% slopes NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X No ___	**Is the Sampled Area within a Wetland?**	**Yes** X **No** ___
Hydric Soil Present?	Yes x No ___		
Wetland Hydrology Present?	Yes x No ___		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [x] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [x] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) **(LRR U)**
- [ ] 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)
- [x] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [x] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___	
Water Table Present?	Yes ___	No X	Depth (inches): ___	
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___	**Wetland Hydrology Present? Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey, NWI

Remarks:

NWI has area listed as PFO1A.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: W7-2

Tree Stratum (Plot size: r = 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Fraxinus pennsylvanica	50	x	FACW
2. Carya ovata	15		FACU
3. Carya glabra	5		FACU
4. Acer rubra	8		FACW
5. Ulmus americana	20		FACW
6. Viburnum prunifolium	2		FACU
7.			
8.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		

Sapling/Shrub Stratum (Plot size: r = 30 ft)			
1. Ulmus americana	10		FACW
2. Acer rubra	10		FACW
3. Fraxinus pennsylvanica	15	x	FACW
4. Campsis radicans	20	x	FAC
5.			
6.			
7.			
8.			
	55 = Total Cover		
50% of total cover: 22.5	20% of total cover: 11		

Herb Stratum (Plot size: r = 30 ft)			
1. Rubus allygheniensis	25	x	FAC
2. Persicaria pennsylvanicum	2		FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	27 = Total Cover		
50% of total cover:	20% of total cover:		

Woody Vine Stratum (Plot size: r = 30 ft)			
1.			
2.			
3. Lonicera japonica	15	x	FAC
4.			
5.			
	15 = Total Cover		
50% of total cover:	20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No** ______

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W7-2

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 6/4	100					silt loam	
5-6	10YR 7/2	95	10YR 6/6	5	C	M	silty clay loam	
7-12	10YR7/2	90	10YR6/6	10	C	M	silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☑ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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** x **No** ______

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD1 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: W7-3

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.136 Long: -88.771 Datum: NAD83

Soil Map Unit Name: Routon silt loam 2-4% slopes NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ______
Water Table Present?	Yes ___	No X	Depth (inches): ______
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ______

Wetland Hydrology Present? Yes X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey, NWI

Remarks:

NWI has area listed as PFO1A.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W7-3

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus palustris	20	x	FACW
2. Celtis laevigata	4		FACW
3. Carya glabra	15	x	FACU
4. Acer rubra	10		FACW
5. Ulmus americana	20	x	FACW
6. Platanus occidentalis	1		FACW
7.			
8.			
	70 = Total Cover		
50% of total cover: 35	20% of total cover: 14		

Sapling/Shrub Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus americana	20	x	FACW
2. Carya glabra	10		FACU
3.			
4.			
5.			
6.			
7.			
8.			
	30 = Total Cover		
50% of total cover: 15	20% of total cover: 6		

Herb Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Urtica dioica	5	x	FAC
2. Persicaria pennsylvanicum	5	x	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Woody Vine Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Toxicodendron radicans	5		FAC
2. Campsis radicans	5		FAC
3. Lonicera japonica	40	x	FAC
4.			
5.			
	55 = Total Cover		
50% of total cover: 27.5	20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No** ___

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W7-3

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 7/4	90	10YR6 7/2	10	C	M	silty clay loam	
5-12	10YR 7/2	85	10YR 7/6	15	C	M	silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☑ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 X No ______

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Shawnee FP-Landfill City/County: Paducah, McCracken County Sampling Date: 5/23/16

Applicant/Owner: TVA State: KY Sampling Point: W008

Investigator(s): David Nestor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): mostly flat Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 37 deg 8' 18.908"N Long: -88 deg 46' 7.387" Datum: NAD83

Soil Map Unit Name: ______ NWI classification: PUBHx

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? **Yes** x **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes x	No ___	Depth (inches): 6-12"
Water Table Present?	Yes x	No ___	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): ___

Wetland Hydrology Present? Yes x **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey, NWI

Remarks:

NWI has wetland listed as PUBHx.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W008

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	35	x	OBL
2. Celtis laevigata	10		FACW
3. Ulmus rubra	5		FAC
4. Acer rubrum	5		FAC
5.			
6.			
7.			
8.			
	55 = Total Cover		
50% of total cover: 27.5	20% of total cover: 11		
Sapling/Shrub Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	12 = Total Cover		
50% of total cover: 6	20% of total cover: 2.4		
Herb Stratum (Plot size: r =)			
1. Scirpus atrovirens	5	x	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	5 = Total Cover		
50% of total cover: 2.5	20% of total cover: 1		
Woody Vine Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

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 %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 5/2		10YR 5/8		C	M	Loamy/Clayey	
6-18	10YR 6/1		10YR 5/8		C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) **(LRR P, T, U)**
- [ ] 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- [ ] Muck Presence (A8) **(LRR U)**
- [ ] 1 cm Muck (A9) **(LRR P, T)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) **(MLRA 150A)**
- [ ] Sandy Mucky Mineral (S1) **(LRR O, S)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) **(LRR P, S, T, U)**
- [ ] Polyvalue Below Surface (S8) **(LRR S, T, U)**
- [ ] Thin Dark Surface (S9) **(LRR S, T, U)**
- [ ] Loamy Mucky Mineral (F1) **(LRR O)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) **(LRR U)**
- [ ] Depleted Ochric (F11) **(MLRA 151)**
- [ ] Iron-Manganese Masses (F12) **(LRR O, P, T)**
- [ ] Umbric Surface (F13) **(LRR P, T, U)**
- [ ] Delta Ochric (F17) **(MLRA 151)**
- [ ] Reduced Vertic (F18) **(MLRA 150A, 150B)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) **(LRR O)**
- [ ] 2 cm Muck (A10) **(LRR S)**
- [ ] Reduced Vertic (F18) **(outside MLRA 150A,B)**
- [ ] Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- [ ] Red Parent Material (TF2)
- [ ] 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** X **No** ______

Remarks:

Hydric soils present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Shawnee FP-Landfill City/County: Paducah, McCracken County Sampling Date: 5/23/16

Applicant/Owner: TVA State: KY Sampling Point: W009

Investigator(s): David Nestor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): mostly flat Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 37 deg 8' 15.181"N Long: -88 deg 46' 28.621" Datum: NAD83

Soil Map Unit Name: ______ NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ___	**Is the Sampled Area within a Wetland?** **Yes** x **No** ___
Hydric Soil Present?	Yes x No ___	
Wetland Hydrology Present?	Yes x No ___	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [x] Surface Water (A1)
- [ ] High Water Table (A2)
- [x] 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)
- [ ] Marl Deposits (B15) **(LRR U)**
- [ ] 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)
- [x] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes x No ___	Depth (inches): 6-12"	
Water Table Present?	Yes x No ___	Depth (inches): ___	
Saturation Present? (includes capillary fringe)	Yes x No ___	Depth (inches): ___	**Wetland Hydrology Present? Yes** x **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey, NWI

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W009

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	25		OBL
2. Celtis laevigata	40	x	FACW
3. Ulmus rubra	35		FAC
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		

Sapling/Shrub Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: r =)			
1. Rubus argutus	10		FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Woody Vine Stratum (Plot size: r =)			
1. Toxicodendron radicans	30	x	FAC
2. Campsis radicans	20		FAC
3.			
4.			
5.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		

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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No** ____

Remarks: (If observed, list morphological adaptations below).

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 Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 5/2	10	10YR 5/8		C	M	Loamy/Clayey	
6-18	10YR 6/1	40	10YR 5/8	60	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 X **No** ______

Remarks:

Hydric soils present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Shawnee FP-Landfill City/County: Paducah, McCracken County Sampling Date: 5/23/16
Applicant/Owner: TVA State: KY Sampling Point: W010
Investigator(s): David Nestor Section, Township, Range: ______
Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat, some slight depressions Slope (%): ______
Subregion (LRR or MLRA): ______ Lat: 37 deg 8' 5.577"N Long: -88 deg 46' 39.435" Datum: NAD83
Soil Map Unit Name: ______ NWI classification: PFO1E
Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ___	**Is the Sampled Area within a Wetland?**	**Yes** x **No** ___
Hydric Soil Present?	Yes x No ___		
Wetland Hydrology Present?	Yes x No ___		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___ No x	Depth (inches): ______	
Water Table Present?	Yes ___ No x	Depth (inches): ______	
Saturation Present? (includes capillary fringe)	Yes ___ No x	Depth (inches): ______	**Wetland Hydrology Present? Yes** x **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
Aerial photos, Soil Survey

Remarks:
Hydrology present.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W010

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Celtis laevigata	60	x	FACW
2. Carya sp.	35		
3. Nyssa sylvatica	5		FAC
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		

Sapling/Shrub Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Symphoricarpos orbiculatus	20	x	FACU
2. Aralia spinosa	2		FAC
3.			
4.			
5.			
6.			
7.			
8.			
	22 = Total Cover		
50% of total cover: 11	20% of total cover: 4.4		

Herb Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ageratina altissima	10		FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Woody Vine Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Parthenocissus quinquefolia	15	x	FACU
2. Toxicodendron radicans	20	x	FAC
3. Lonicera japonica	10		FACU
4. Campsis radicans	5		FAC
5.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No** ___

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W010

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
1-4	10YR 4/3	30			C	M	Loamy/Clayey	
	10YR 6/2	30			C	M	Loamy/Clayey	
4-12	10YR 6/1	60			C	M	Loamy/Clayey	
			7.5YR 5/8	40	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 X No ______

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Shawnee FP-Landfill City/County: Paducah, McCracken County Sampling Date: 5/23/16

Applicant/Owner: TVA State: KY Sampling Point: W011

Investigator(s): David Nestor Section, Township, Range: ____

Landform (hillslope, terrace, etc.): slight depression Local relief (concave, convex, none): mostly flat, some slight depressions Slope (%): ____

Subregion (LRR or MLRA): ____ Lat: 37 deg 8' 3.067"N Long: -88 deg 46' 33.614" Datum: NAD83

Soil Map Unit Name: ____ NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ____	**Is the Sampled Area within a Wetland?**	**Yes** x **No** ____
Hydric Soil Present?	Yes x No ____		
Wetland Hydrology Present?	Yes x No ____		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ____ No x Depth (inches): ____

Water Table Present? Yes ____ No x Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No x Depth (inches): ____

Wetland Hydrology Present? Yes x **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey

Remarks:

Hydrology present.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W011

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Celtis laevigata	60	x	FACW
2. Ulmus rubra	40		FAC
3.			
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		

Sapling/Shrub Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carex tribuloides	50	x	FACW
2. Microstegium vimineum	20		FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	70 = Total Cover		
50% of total cover: 35	20% of total cover: 14		

Woody Vine Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No** ___

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W011

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 5/2	10	10YR 5/8		C	M	Loamy/Clayey	
6-18	10YR 6/1	40	10YR 5/8	60	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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** X **No** ______

Remarks:

Hydric soils present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Shawnee FP-Landfill City/County: Paducah, McCracken County Sampling Date: 5/23/16

Applicant/Owner: TVA State: KY Sampling Point: W012

Investigator(s): David Nestor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): mostly flat, some slight depressions Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 37 deg 8' 4.770"N Long: -88 deg 46' 34.459" Datum: NAD83

Soil Map Unit Name: ______ NWI classification: PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ___	**Is the Sampled Area within a Wetland?**	**Yes** x **No** ___
Hydric Soil Present?	Yes x No ___		
Wetland Hydrology Present?	Yes x No ___		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes x No ___ Depth (inches): 4-6 inches

Water Table Present? Yes x No ___ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes x No ___ Depth (inches): ______

Wetland Hydrology Present? Yes x **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Aerial photos, Soil Survey

Remarks:

Hydrology present.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W012

Tree Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Taxodium distichum	70	x	OBL
2. Ulmus rubra	20		FAC
3. Celtis laevigata	10		FACW
4.			
5.			
6.			
7.			
8.			
= Total Cover	100		
50% of total cover: 50	20% of total cover: 20		

Sapling/Shrub Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover			
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
= Total Cover			
50% of total cover:	20% of total cover:		

Woody Vine Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
50% of total cover:	20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

Pneumatophores present.

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
0-6	10YR 5/2	10	10YR 5/8		C	M	Loamy/Clayey	
6-18	10YR 6/1	40	10YR 5/8	60	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 X **No** ______

Remarks:

Hydric soils present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD-2 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: W-13

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): agricultural field/wooded Local relief (concave, convex, none): none Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.132 Long: -88.780 Datum: NAD83

Soil Map Unit Name: Calloway silt loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology x significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ___	**Is the Sampled Area within a Wetland?** **Yes** x **No** ___
Hydric Soil Present?	Yes x No ___	
Wetland Hydrology Present?	Yes x No ___	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ______

Water Table Present? Yes ___ No x Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No x Depth (inches): ______

Wetland Hydrology Present? Yes x **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Two ponds are connected to the west side of this wetland. Flow appears to be to the west and south and is interrupted by field roads and ditches.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W13

Tree Stratum (Plot size: linear area)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubra	40	Yes	FAC
2. Liquidambar styraciflua	10		FAC
3. Quercus palustris	15		FACW
4. Quercus falcata	10		FACU
5. Viburnum prunifolium	2		FACU
6. Betula nigra	3		FACW
7.			
8.			
	100 = Total Cover		

50% of total cover: 50 20% of total cover: 20

Sapling/Shrub Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubra	10	y	FAC
2. Betula nigra	10	y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	20 = Total Cover		

50% of total cover: 10 20% of total cover: 4

Herb Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Urtica dioica	5		FACU
2. Lonicera japonica	5		FAC
3. Rhexia virginica	15		OBL
4. Cyperus stirogosus	15		FACW
5. Eleocharis spp.	5		FACW
6. Echinochloa spp.	15		FAC
7. Panicum virgatum	20	y	FAC
8. Dichanthelium acuminatum var. lindeimeri	15		FAC
9.			
10.			
11.			
12.			
	80 = Total Cover		

50% of total cover: 40 20% of total cover: 16

Woody Vine Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Toxicodendron radicans	20	y	FAC
2.			
3.			
4.			
5.			
	20 = Total Cover		

50% of total cover: 10 20% of total cover: 4

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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	6.97	x 1 =	6.97
FACW species	22.33	x 2 =	44.66
FAC species	62.79	x 3 =	188.37
FACU species	7.91	x 4 =	31.63
UPL species		x 5 =	
Column Totals:	100 (A)		271.62 (B)

Prevalence Index = B/A = 2.72

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No** ______

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W13

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 7/2	75	10YR 6/6	25			silty clay	
4-6	10YR 6/2	60	10YR 5/3	30				
			10YR 6/8	10				
6-12	10YR 6/1	90	10YR 7/6	10				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☑ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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** x **No** ______

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD-2 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: W14

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ____

Landform (hillslope, terrace, etc.): agricultural field/wooded Local relief (concave, convex, none): none Slope (%): 0-1

Subregion (LRR or MLRA): ____ Lat: 37.129 Long: 88.781 Datum: NAD83

Soil Map Unit Name: Calloway silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil x, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x	No ____
Hydric Soil Present?	Yes x	No ____
Wetland Hydrology Present?	Yes x	No ____

Is the Sampled Area within a Wetland? **Yes** x **No** ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ____	No x	Depth (inches): ____
Water Table Present?	Yes ____	No x	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No x	Depth (inches): ____

Wetland Hydrology Present? **Yes** x **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Drainage through an agricultural field into a wooded area.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W14

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubra	60	yes	FAC
2. Platanus occidentalis	15		FACW
3. Celtis occidentalis	5		FACU
4. Carya tomentosa	5		FACU
5. Celtis laevigata	10		FACW
6.			
7.			
8.			
	95 = Total Cover		
50% of total cover: 47.5	20% of total cover: 19		

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)			
1. Toxicodendron radicans	1		FAC
2. Urtica dioica	2		FACU
3. Polygonum spp.	5		FACW
4. Euthamia caroliniana	2		FAC
5. Campsis radicans	2		FAC
6. Impatiens capensis	1		FACW
7. Lonicera japonica	5		FAC
8. Panicum virgatum	50	y	FAC
9. Cyperus stirogosus	20	y	FACW
10.			
11.			
12.			
	88 = Total Cover		
50% of total cover: 44	20% of total cover: 17.6		

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W14

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 7/2	75	10YR 6/6	25			Silty clay	
4-6	10YR 6/2	60	10YR 5/3	30			silt loam	
			10YR 6/8	10				
6-12	10YR 6/1	90	10YR 7/6	10				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☑ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 X No ______

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD-14 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: W15

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ____

Landform (hillslope, terrace, etc.): flat woods and open field Local relief (concave, convex, none): slight depressions Slope (%): 0-1

Subregion (LRR or MLRA): ____ Lat: 37.132 Long: -88.776 Datum: NAD83

Soil Map Unit Name: Routon silt loam NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	No ____	Is the Sampled Area within a Wetland? Yes X No ____
Hydric Soil Present?	Yes x	No ____	
Wetland Hydrology Present?	Yes x	No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No x Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No x Depth (inches): ____

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Hydrology was impacted by the RR crossing to the south and road bed to the north.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W15

Tree Stratum (Plot size: 30ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus palustris	15	y	FACW
2. Betula nigra	2		FACW
3. Ulmus americana	15	Y	FACW
4. Acer rubra	15	Y	FACW
5. Plantanus occidentalis	5		FACW
6. Quercus stellata	10		UPL
7.			
8.			
	62 = Total Cover		

50% of total cover: ______ 20% of total cover: ______

Sapling/Shrub Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	______ = Total Cover		

50% of total cover: ______ 20% of total cover: ______

Herb Stratum (Plot size: r =)			
1. Ambrosia artemisiifolia	5		FACU
2. Toxicodendron radicans	5		FAC
3. Persicaria pensylvanica	5		FACW
4. Rubus allegheniensis	5		FACU
5. Cyperus albomarginatus	30	Y	FAC
6. Lonicera japanica	10		FAC
7.			
8.			
9.			
10.			
11.			
12.			
	60 = Total Cover		

50% of total cover: ______ 20% of total cover: ______

Woody Vine Stratum (Plot size: r =)			
1. campsis radicans	5	y	FAC
2.			
3.			
4.			
5.			
	______ = Total Cover		

50% of total cover: ______ 20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No** ______

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W15

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 67/2	60	10YR 6/4	35			Silty Clay	
			10YR 7/8	5		M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) **(LRR P, T, U)**
- [ ] 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- [ ] Muck Presence (A8) **(LRR U)**
- [ ] 1 cm Muck (A9) **(LRR P, T)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) **(MLRA 150A)**
- [ ] Sandy Mucky Mineral (S1) **(LRR O, S)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) **(LRR P, S, T, U)**
- [ ] Polyvalue Below Surface (S8) **(LRR S, T, U)**
- [ ] Thin Dark Surface (S9) **(LRR S, T, U)**
- [ ] Loamy Mucky Mineral (F1) **(LRR O)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) **(LRR U)**
- [ ] Depleted Ochric (F11) **(MLRA 151)**
- [ ] Iron-Manganese Masses (F12) **(LRR O, P, T)**
- [ ] Umbric Surface (F13) **(LRR P, T, U)**
- [ ] Delta Ochric (F17) **(MLRA 151)**
- [ ] Reduced Vertic (F18) **(MLRA 150A, 150B)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) **(LRR O)**
- [ ] 2 cm Muck (A10) **(LRR S)**
- [ ] Reduced Vertic (F18) **(outside MLRA 150A,B)**
- [ ] Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- [ ] Red Parent Material (TF2)
- [ ] 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 X No ______

Remarks:
This area is a depression with poor drainage to the roadside ditch to the north.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPD-14 City/County: Paducah, McCracken County Sampling Date: 10/4/16

Applicant/Owner: TVA State: KY Sampling Point: W16

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): flat woods and open field Local relief (concave, convex, none): slight depressions Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.131 Long: -88.776 Datum: NAD83

Soil Map Unit Name: Routon silt loam NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology x significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x	No ___	**Is the Sampled Area within a Wetland?** **Yes** x **No** ___
Hydric Soil Present?	Yes x	No ___	
Wetland Hydrology Present?	Yes x	No ___	

Remarks:

This area is located in parcel KSPPD14 on the south side of the RR tracks. The land appears to drain to the north and west. It is rutted from logging or hunting trails. Drainage is to the ditch along the RR tracks. One small pond is located on the NW side.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [x] Water Marks (B1)
- [x] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [x] Water-Stained Leaves (B9)
- [x] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) **(LRR U)**
- [ ] 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)
- [x] Drainage Patterns (B10)
- [x] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [x] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes x	No ___	Depth (inches): 1-2
Water Table Present?	Yes x	No ___	Depth (inches): 4-6
Saturation Present? (includes capillary fringe)	Yes ___	No x	Depth (inches): ___

Wetland Hydrology Present? Yes x **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

There is a small pond on the northwest end of the property, depth unknown. The surface water and saturation are recorded for the small ponds and ruts.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W16

Tree Stratum (Plot size: 30ft r)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus palustris	10		FACW
2. Betula nigra	15	y	FACW
3. Ulmus americana	15	y	FACW
4. Acer rubrum	25	y	FACW
5. Fraxinus pennsylvanica	5		FACW
6. Quercus stellata	5		UPL
7.			
8.			
	75 = Total Cover		

50% of total cover: ____ 20% of total cover: ____

Sapling/Shrub Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

50% of total cover: ____ 20% of total cover: ____

Herb Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Echinochloa crus-galli	5		FAC
2. Toxicodendron radicans	5		FAC
3. Persicaria pensylvanica	15	y	FACW
4. Rubus allegheniensis	5		FACU
5. Cyperus albomarginatus	5		FAC
6. Lonicera japanica	10		FAC
7. Bidens aristosa	3		FACW
8.			
9.			
10.			
11.			
12.			
	48 = Total Cover		

50% of total cover: ____ 20% of total cover: ____

Woody Vine Stratum (Plot size: r =)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Campsis radicans	5	y	FAC
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: 5 20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No** ____

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W16

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 67/2	60	10YR 6/4	35			Silty Clay	
			10YR 7/8	5				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 X No ______

Remarks:

This area is a depression with poor drainage due to the railroad and farming practices.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF KSPPF-3 City/County: Paducah, McCracken County Sampling Date: 9/29/16

Applicant/Owner: TVA State: KY Sampling Point: W-17

Investigator(s): Jim Orr, Daniel Wade Section, Township, Range: ______

Landform (hillslope, terrace, etc.): agricultural field/wooded Local relief (concave, convex, none): none Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.131 Long: -88.763 Datum: NAD83

Soil Map Unit Name: Vicksburg silt loam NWI classification: NWI

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ___	**Is the Sampled Area within a Wetland?** **Yes** x **No** ___
Hydric Soil Present?	Yes x No ___	
Wetland Hydrology Present?	Yes x No ___	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ______

Water Table Present? Yes ___ No x Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No x Depth (inches): ______

Wetland Hydrology Present? Yes x **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: UPL-17

Tree Stratum (Plot size: 30ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	10		FAC
2. Platanus occidentalis	5		FACW
3. Ulmus americana	10		FACW
4. Betual nigra	60	Y	FACW
5. Celtis laevigata	15		FACW
6. Acer negundo	5		FACW
7.			
8.			
	95 = Total Cover		
50% of total cover:	20% of total cover:		

Sapling/Shrub Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: r =)			
1. Urtica dioica	2		FACU
2. Toxicodendron radicans	3		FAC
3. Persicaria pensylvanica	2		FACW
4. Ageratina altissima	10		FACU
5. Campsis radicans	5		FAC
6. Lonicera japanica	20	Y	FAC
7.			
8.			
9.			
10.			
11.			
12.			
	56 = Total Cover		
50% of total cover: 28	20% of total cover: 11.2		

Woody Vine Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: UPL-17

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 5/4	100					Silty Clay	
4-6	10YR 7/3	90	10YR 7/8	10		M	Silty Clay	
6-12	10YR 4/6	100					Silty Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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** X **No** ____

Remarks:

This area is a depression adjacent to the deeply cut stream bed. This is the only area where river birch were abundant on the property.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF City/County: Paducah, McCracken County Sampling Date: 11/2/2016

Applicant/Owner: TVA State: KY Sampling Point: W-18

Investigator(s): HO, DW Section, Township, Range: ______

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): 1-2

Subregion (LRR or MLRA): ______ Lat: 37.160873 Long: -88.791244 Datum: NAD83

Soil Map Unit Name: Routon silt loam 2-4 slopes NWI classification: PFO

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ____		**Is the Sampled Area within a Wetland?** **Yes** x **No** ____
Hydric Soil Present? Yes x No ____		
Wetland Hydrology Present? Yes x No ____		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [x] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [x] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) **(LRR U)**
- [ ] 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)
- [x] 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)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ____ No x Depth (inches): ______

Water Table Present? Yes ____ No x Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ____ No x Depth (inches): ______

Wetland Hydrology Present? Yes x **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

wooded swale in field

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W-18

Tree Stratum (Plot size: 50ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	50	y	FAC
2. Platinus occidentalis	5		FACW
3. Acer saccharinum	5		FAC
4. Fraxinus pennsylvanica	10		FACW
5. Celtis laevigata	10		FACW
6. Robina pseudoacacia	3		FACU
7.			
8.			
	83 = Total Cover		
50% of total cover: 41.5	20% of total cover:		

Sapling/Shrub Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Persicaria pensylvanica	20	y	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	95 = Total Cover		
50% of total cover: 47.5	20% of total cover: 19		

Woody Vine Stratum (Plot size: r =)	Absolute % Cover	Dominant Species?	Indicator Status
1. Lonicera japonica	25	y	FAC
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W-18

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
0-12	10YR 5/2	90	10YR 8/8	10		m	silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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 X No ______

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: TVA-SHF City/County: Paducah, McCracken County Sampling Date: 11/2/2016

Applicant/Owner: TVA State: KY Sampling Point: W-19

Investigator(s): Jim Orr, Winnie Davis Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ag field Local relief (concave, convex, none): concave Slope (%): 0-1

Subregion (LRR or MLRA): ______ Lat: 37.1313 Long: -88.7787 Datum: NAD83

Soil Map Unit Name: Routon silt loam 2-4 slopes NWI classification: PUB/PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x 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 x No ___	**Is the Sampled Area within a Wetland?** **Yes** x **No** ___
Hydric Soil Present?	Yes x No ___	
Wetland Hydrology Present?	Yes x No ___	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is 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)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ 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)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes x No ___ Depth (inches): 3-4"

Water Table Present? Yes ___ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ___

Wetland Hydrology Present? Yes x **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W-19

Tree Stratum (Plot size: Edge of wet)	Absolute % Cover	Dominant Species?	Indicator Status
1. Betula nigra	10	y	FACW
2. Acer rubrum	5		FACW
3.			
4.			
5.			
6.			
7.			
8.			
	15 = Total Cover		
50% of total cover: 7.5	20% of total cover:		

Sapling/Shrub Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: r =)			
1. Juncus effusus	5		OBL
2. Carex spp.	5		FACW
3. Andropogon virginicus	15		FAC
4. Ludwigia alternifolia	5		OBL
5. Ambrosia artemisiifolia	5		FACU
6. Symphyotrichum pilosum	25	y	FAC
7. Eleochirus sp.	20	y	FACW
8. Juncus tenuis	4		FAC
9. Cyperus strigosus	5		FACW
10. Persicaria pensylvanica	5		FACW
11. Rhexia virginica	6		OBL
12.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		

Woody Vine Stratum (Plot size: r =)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of 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 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** x **No**

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W-19

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 7/2	90	10YR 6/8	10	RM	M	Silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ 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** X **No** ______

Remarks:

Site: W001	Rater(s): David Nestor	Date: 5/12/2016

1	1
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☐ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☑ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

9	10
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☑ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☑ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

12	22
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☐ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☑ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☑ Regularly inundated/saturated (3) [BR/CM (4)]
- ☐ Seasonally inundated (2) [BR/CM (4)]
- ☐ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ____________________

9	31
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☑ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☑ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☑ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

31

Site: W001	Rater(s): David Nestor	Date: 5/12/2016

31
subtotal previous page

5	36
max 10 pts.	subtotal

raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- ☐ Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- ☐ Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- ☐ Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- ✓ Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- ☐ Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- ☐ Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- ☐ Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- ☐ Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- ☐ Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- ☐ Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- ☐ Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

8	44
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- 0 Aquatic bed
- 1 Emergent
- 0 Shrub
- 2 Forest
- 0 Mudflats
- 0 Open water <20 acres (8 ha)
- 0 Moss/lichen. Other ____________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- ☐ High (5)
- ☐ Moderately high (4) [BR/CM (5)]
- ☐ Moderate (3)[BR/CM (5)]
- ✓ Moderately low (2) [BR/CM (3)]
- ☐ Low (1) [BR/CM (2)]
- ☐ None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- ☐ Extensive >75% cover (-5)
- ☐ Moderate 25-75% cover (-3)
- ☐ Sparse 5-25% cover (-1)
- ☐ Nearly absent <5% cover (0)
- ✓ Absent (1)

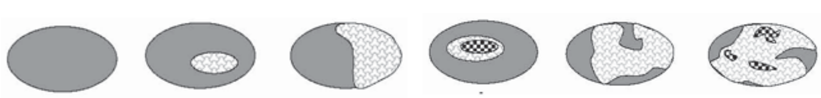
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- 0 Vegetated hummocks/tussocks
- 0 Coarse woody debris >15 cm (6 in.)
- 0 Standing dead >25 cm (10 in.) dbh
- 2 Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

44

GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: W002	Rater(s): David Nestor	Date: 5/12/2016

0	0
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☐ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☑ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

4	4
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☐ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☑ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☐ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☑ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

11	15
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☑ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☑ Seasonally inundated (2) [BR/CM (4)]
- ☐ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ____________________

8	23
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☑ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☐ Moderately good (4)
- ☑ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☐ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

23

Site: W002	Rater(s): David Nestor	Date: 5/12/2016

23
subtotal previous page

5	28
max 10 pts.	subtotal

raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [ ] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [x] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

7	35
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- 0 Aquatic bed
- 1 Emergent
- 0 Shrub
- 1 Forest
- 0 Mudflats
- 0 Open water <20 acres (8 ha)
- 0 Moss/lichen. Other ______________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [ ] Moderate (3)[BR/CM (5)]
- [x] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [x] Nearly absent <5% cover (0)
- [ ] Absent (1)

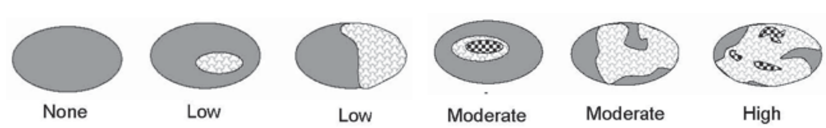
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- 0 Vegetated hummocks/tussocks
- 1 Coarse woody debris >15 cm (6 in.)
- 0 Standing dead >25 cm (10 in.) dbh
- 2 Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

35 — **GRAND TOTAL (max 100 pts)**

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: W003	Rater(s): David Nestor	Date: 5/12/2016

0	0
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☐ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☑ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

11	11
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☑ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☑ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☐ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

10	21
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☑ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☐ Seasonally inundated (2) [BR/CM (4)]
- ☑ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ____________________

9	30
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☑ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☑ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☐ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

30

Site: W003	**Rater(s):** David Nestor	**Date:** 5/12/2016

30
subtotal previous page

0 (max 10 pts.) | 30 (subtotal)

Metric 5. Special Wetlands

raw score*:

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [ ] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

5 (max 20 pts.) | 35 (subtotal)

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- 0 Aquatic bed
- 2 Emergent
- 0 Shrub
- 2 Forest
- 0 Mudflats
- 0 Open water <20 acres (8 ha)
- 0 Moss/lichen. Other ____________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [ ] Moderate (3)[BR/CM (5)]
- [x] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [x] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

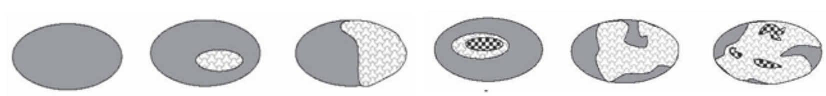
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- 0 Vegetated hummocks/tussocks
- 1 Coarse woody debris >15 cm (6 in.)
- 0 Standing dead >25 cm (10 in.) dbh
- 1 Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

35 — **GRAND TOTAL (max 100 pts)**

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: W004	Rater(s): David Nestor	Date: 5/12/2016

1	1
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☐ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☑ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

11	12
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☑ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☑ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☐ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

10	22
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☑ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☐ Seasonally inundated (2) [BR/CM (4)]
- ☑ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ___________________

10	32
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☑ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☑ Good (5)
- ☐ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☐ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

32

Site:	W004	Rater(s):	David Nestor	Date:	5/12/2016

32
subtotal previous page

0	32
max 10 pts.	subtotal

raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- ☐ Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- ☐ Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- ☐ Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- ☐ Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- ☐ Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- ☐ Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- ☐ Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- ☐ Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- ☐ Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- ☐ Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- ☐ Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

3	35
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- 0 Aquatic bed
- 2 Emergent
- 0 Shrub
- 2 Forest
- 0 Mudflats
- 0 Open water <20 acres (8 ha)
- 0 Moss/lichen. Other ____________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- ☐ High (5)
- ☐ Moderately high (4) [BR/CM (5)]
- ☐ Moderate (3)[BR/CM (5)]
- ☑ Moderately low (2) [BR/CM (3)]
- ☐ Low (1) [BR/CM (2)]
- ☐ None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- ☑ Extensive >75% cover (-5)
- ☐ Moderate 25-75% cover (-3)
- ☐ Sparse 5-25% cover (-1)
- ☐ Nearly absent <5% cover (0)
- ☐ Absent (1)

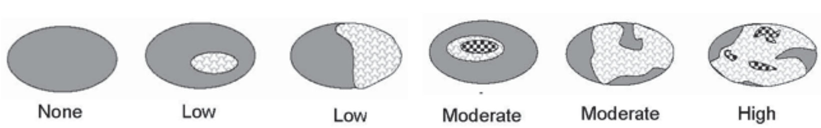
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- 0 Vegetated hummocks/tussocks
- 1 Coarse woody debris >15 cm (6 in.)
- 0 Standing dead >25 cm (10 in.) dbh
- 1 Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

35	**GRAND TOTAL (max 100 pts)**

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site:	W005	Rater(s):	David Nestor	Date:	5/12/2016

0	0
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☐ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☑ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

11	11
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☑ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☑ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☐ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

10	21
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☑ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☐ Seasonally inundated (2) [BR/CM (4)]
- ☑ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ___________________

9	30
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☑ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☑ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☐ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

30

Site: W005	Rater(s): David Nestor	Date: 5/12/2016

30
subtotal previous page

0	30
max 10 pts.	subtotal

raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [ ] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

3	33
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- 0 Aquatic bed
- 2 Emergent
- 0 Shrub
- 2 Forest
- 0 Mudflats
- 0 Open water <20 acres (8 ha)
- 0 Moss/lichen. Other ______________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [ ] Moderate (3)[BR/CM (5)]
- [x] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [x] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

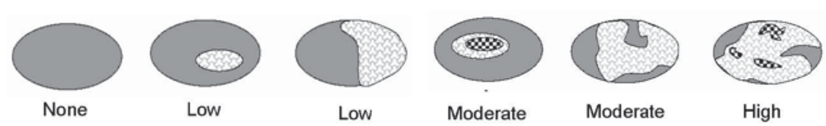
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- 0 Vegetated hummocks/tussocks
- 1 Coarse woody debris >15 cm (6 in.)
- 0 Standing dead >25 cm (10 in.) dbh
- 1 Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

33	GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

TENNESSEE VALLEY AUTHOROITY RAPID ASSESSMENT MEHTOD: Assessing Wetland Condition, Functional Capacity, Quality

TVARAM FIELD FORM

Site:	W006	Rater(s):	David Nestor	Date:	5/12/2016

1	1
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☐ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☑ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

14	15
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☑ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☐ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☑ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☐ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

10	25
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☑ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☐ Seasonally inundated (2) [BR/CM (4)]
- ☑ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ___________________

9	34
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☑ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☑ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☐ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

34

Site: W006	**Rater(s):** David Nestor	**Date:** 5/12/2016

34
subtotal previous page

0	34
max 10 pts.	subtotal

raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- ☐ Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- ☐ Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- ☐ Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- ☐ Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- ☐ Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- ☐ Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- ☐ Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- ☐ Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- ☐ Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- ☐ Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- ☐ Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

3	37
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- 0 Aquatic bed
- 2 Emergent
- 0 Shrub
- 2 Forest
- 0 Mudflats
- 0 Open water <20 acres (8 ha)
- 0 Moss/lichen. Other ____________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- ☐ High (5)
- ☐ Moderately high (4) [BR/CM (5)]
- ☐ Moderate (3)[BR/CM (5)]
- ☑ Moderately low (2) [BR/CM (3)]
- ☐ Low (1) [BR/CM (2)]
- ☐ None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- ☑ Extensive >75% cover (-5)
- ☐ Moderate 25-75% cover (-3)
- ☐ Sparse 5-25% cover (-1)
- ☐ Nearly absent <5% cover (0)
- ☐ Absent (1)

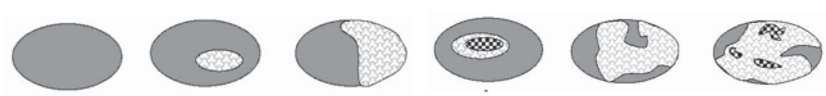
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- 0 Vegetated hummocks/tussocks
- 1 Coarse woody debris >15 cm (6 in.)
- 0 Standing dead >25 cm (10 in.) dbh
- 1 Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

37

GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: TVA, SHF W7-1	Rater(s): JRO, DW	Date: September 29, 2016

0	0
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.

- [ ] >50 acres (>20.2 ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- [ ] 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- [ ] 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- [ ] 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- [ ] 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- [x] <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

6	6
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- [ ] WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- [ ] MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- [x] NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [x] LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- [ ] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- [ ] High. Urban, industrial, open pasture, row cropping, mining, construction (1)

7	13
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3) [BR/CM (5)]
- [x] Precipitation (1) [unless BR/CM primary source (5)]
- [ ] Seasonal/intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- [ ] 100-year floodplain (1)
- [ ] Between stream/lake and other human use (1)
- [x] Part of wetland/upland (e.g., forest), complex (1)
- [ ] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

- [ ] >0.7 m (27.6 in.) (3)
- [ ] 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- [x] <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.

- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3) [BR/CM (4)]
- [ ] Seasonally inundated (2) [BR/CM (4)]
- [x] Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- [ ] None or none apparent (12)
- [ ] Recovered (7)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [x] ditch
- [ ] tile (including culvert)
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other ___________________

12	25
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.

- [ ] None or none apparent (4)
- [x] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [x] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.

- [ ] None or none apparent (9)
- [x] Recovered (6)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [x] mowing
- [ ] grazing
- [ ] clearcutting
- [x] selective cutting
- [x] farming
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] woody debris removal
- [ ] sedimentation
- [ ] dredging
- [ ] nutrient enrichment

25

Site: TVA, SHF W7-1	Rater(s): JRO, DW	Date: September 29, 2016

25
subtotal previous page

5	30
max 10 pts.	subtotal

5
raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [x] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only “historic”]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

6	36
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [ ] Emergent
- [ ] Shrub
- [2] Forest
- [ ] Mudflats
- [ ] Open water <20 acres (8 ha)
- [ ] Moss/lichen. Other _____________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland’s vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland’s vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland’s vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [x] Moderate (3)[BR/CM (5)]
- [ ] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [x] Nearly absent <5% cover (0)
- [ ] Absent (1)

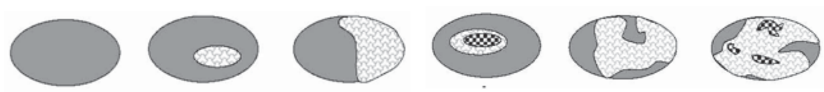
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [ ] Vegetated hummocks/tussocks
- [1] Coarse woody debris >15 cm (6 in.)
- [ ] Standing dead >25 cm (10 in.) dbh
- [ ] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

36 — **GRAND TOTAL (max 100 pts)**

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: TVA, SHF W7-2	Rater(s): JRO, DW	Date: September 29, 2016

2	2
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- [ ] >50 acres (>20.2 ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- [ ] 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- [ ] 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- [x] 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- [ ] 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- [ ] <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

9	11
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- [ ] WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- [x] MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [x] LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- [ ] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- [ ] High. Urban, industrial, open pasture, row cropping, mining, construction (1)

9	20
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- [ ] High pH groundwater (5)
- [ ] Other groundwater (3) [BR/CM (5)]
- [x] Precipitation (1) [unless BR/CM primary source (5)]
- [ ] Seasonal/intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- [ ] 100-year floodplain (1)
- [ ] Between stream/lake and other human use (1)
- [x] Part of wetland/upland (e.g., forest), complex (1)
- [ ] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- [ ] >0.7 m (27.6 in.) (3)
- [ ] 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- [x] <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3) [BR/CM (4)]
- [ ] Seasonally inundated (2) [BR/CM (4)]
- [x] Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- [ ] None or none apparent (12)
- [x] Recovered (7)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed
- [x] ditch
- [ ] tile (including culvert)
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other ___________________

12	32
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- [ ] None or none apparent (4)
- [x] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [x] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.
- [ ] None or none apparent (9)
- [x] Recovered (6)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed
- [x] mowing
- [ ] grazing
- [ ] clearcutting
- [x] selective cutting
- [x] farming
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] woody debris removal
- [ ] sedimentation
- [ ] dredging
- [ ] nutrient enrichment

32

Site: TVA, SHF W7-2	Rater(s): JRO, DW	Date: September 29, 2016

32
subtotal previous page

5	37
max 10 pts.	subtotal

Metric 5. Special Wetlands

5
raw score*

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [✓] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

11	48
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [1] Shrub
- [2] Forest
- [ ] Mudflats
- [ ] Open water <20 acres (8 ha)
- [ ] Moss/lichen. Other ______________

Vegetation Community Cover Scale

0 =	Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 =	Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 =	Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 =	Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [✓] Moderate (3)[BR/CM (5)]
- [ ] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low =	Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod =	Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high =	A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [✓] Nearly absent <5% cover (0)
- [ ] Absent (1)

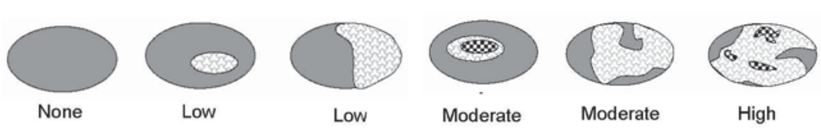
Mudflat and Open Water Class Quality

0 =	Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 =	Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 =	Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 =	High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [1] Vegetated hummocks/tussocks
- [1] Coarse woody debris >15 cm (6 in.)
- [2] Standing dead >25 cm (10 in.) dbh
- [ ] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 =	Absent
1 =	Present in very small amounts or if more common of marginal quality
2 =	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 highest quality

48

GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: TVA, SHF W7-3	Rater(s): JRO, DW	Date: September 29, 2016

2	2
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☑ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

9	11
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☑ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☑ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

11	22
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☐ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☐ Seasonally inundated (2) [BR/CM (4)]
- ☑ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☑ Recovered (7)
- ☐ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☑ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ___________________

14	36
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☑ Recovered (3)
- ☐ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☑ Very good (6)
- ☐ Good (5)
- ☐ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☑ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☑ mowing
- ☐ grazing
- ☐ clearcutting
- ☑ selective cutting
- ☑ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

36

Site: TVA, SHF W7-3	Rater(s): JRO, DW	Date: September 29, 2016

36
subtotal previous page

5	41
max 10 pts.	subtotal

5
raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [✓] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

12	53
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [2] Shrub
- [2] Forest
- [ ] Mudflats
- [ ] Open water <20 acres (8 ha)
- [ ] Moss/lichen. Other ______________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [✓] Moderate (3)[BR/CM (5)]
- [ ] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [✓] Nearly absent <5% cover (0)
- [ ] Absent (1)

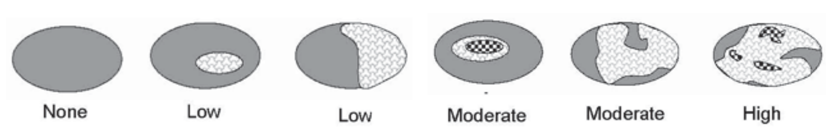
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [1] Vegetated hummocks/tussocks
- [1] Coarse woody debris >15 cm (6 in.)
- [2] Standing dead >25 cm (10 in.) dbh
- [ ] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

53

GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: W008	Rater(s): David Nestor	Date: 05/23/2016

	0
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☐ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☑ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

10	10
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☑ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☐ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☐ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☑ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

13	23
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☑ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☑ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☐ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☑ Regularly inundated/saturated (3) [BR/CM (4)]
- ☐ Seasonally inundated (2) [BR/CM (4)]
- ☐ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ___________________

	23
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☑ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☑ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☑ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

23

Site: W008	**Rater(s):** David Nestor	**Date:** 05/23/2016

23
subtotal previous page

0	23
max 10 pts.	subtotal

raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [ ] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only “historic”]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

11	34
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [0] Aquatic bed
- [2] Emergent
- [0] Shrub
- [1] Forest
- [0] Mudflats
- [0] Open water <20 acres (8 ha)
- [0] Moss/lichen. Other ______________

Vegetation Community Cover Scale

- 0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
- 1 = Present and either comprises a small part of wetland’s vegetation and is of moderate quality, or comprises a significant part but is of low quality
- 2 = Present and either comprises a significant part of wetland’s vegetation and is of moderate quality, or comprises a small part and is of high quality
- 3 = Present and comprises a significant part or more of wetland’s vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [✓] Moderate (3)[BR/CM (5)]
- [ ] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

- low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
- mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
- high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [✓] Nearly absent <5% cover (0)
- [ ] Absent (1)

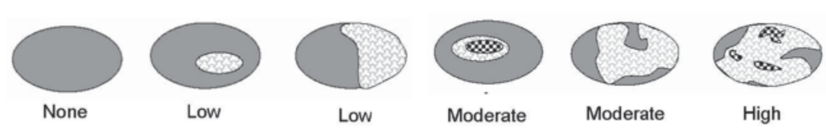
Mudflat and Open Water Class Quality

- 0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
- 1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
- 2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
- 3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [0] Vegetated hummocks/tussocks
- [2] Coarse woody debris >15 cm (6 in.)
- [1] Standing dead >25 cm (10 in.) dbh
- [2] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

- 0 = Absent
- 1 = Present in very small amounts or if more common of marginal quality
- 2 = 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 highest quality

34	**GRAND TOTAL (max 100 pts)**

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

TENNESSEE VALLEY AUTHOROITY RAPID ASSESSMENT MEHTOD: Assessing Wetland Condition, Functional Capacity, Quality
TVARAM FIELD FORM

Site: W009	**Rater(s):** David Nestor	**Date:** 5/12/2016

2	2
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☑ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

10	12
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☑ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☐ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☐ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☑ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

12	24
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☑ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☐ Part of wetland/upland (e.g., forest), complex (1)
- ☑ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☑ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☐ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☑ Seasonally inundated (2) [BR/CM (4)]
- ☐ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ____________________

9	33
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☑ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☑ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☑ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

33

Site:	W009	Rater(s):	David Nestor	Date:	5/12/2016

33
subtotal previous page

0	33
max 10 pts.	subtotal

raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- ☐ Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- ☐ Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- ☐ Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- ☐ Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- ☐ Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- ☐ Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- ☐ Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- ☐ Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- ☐ Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- ☐ Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- ☐ Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

8	41
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- 0 Aquatic bed
- 2 Emergent
- 0 Shrub
- 1 Forest
- 0 Mudflats
- 0 Open water <20 acres (8 ha)
- 0 Moss/lichen. Other ______

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- ☐ High (5)
- ☐ Moderately high (4) [BR/CM (5)]
- ☐ Moderate (3)[BR/CM (5)]
- ☑ Moderately low (2) [BR/CM (3)]
- ☐ Low (1) [BR/CM (2)]
- ☐ None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- ☐ Extensive >75% cover (-5)
- ☐ Moderate 25-75% cover (-3)
- ☐ Sparse 5-25% cover (-1)
- ☐ Nearly absent <5% cover (0)
- ☑ Absent (1)

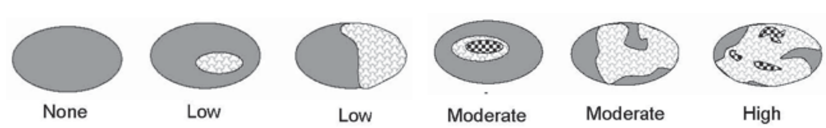
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- 0 Vegetated hummocks/tussocks
- 1 Coarse woody debris >15 cm (6 in.)
- 0 Standing dead >25 cm (10 in.) dbh
- 2 Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

41	**GRAND TOTAL (max 100 pts)**

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: W010	Rater(s): David Nestor	Date: 05/23/2016

0	0
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☐ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☑ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

11	11
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☑ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☑ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☐ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

10	21
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☑ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☐ Seasonally inundated (2) [BR/CM (4)]
- ☑ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ____________________

9	30
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☑ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☑ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☐ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

30

Site: W010	Rater(s): David Nestor	Date: 05/23/2016

30
subtotal previous page

0	30
max 10 pts.	subtotal

raw score*:

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [ ] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

4	34
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- 0 Aquatic bed
- 1 Emergent
- 0 Shrub
- 1 Forest
- 0 Mudflats
- 0 Open water <20 acres (8 ha)
- 0 Moss/lichen. Other ____________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [ ] Moderate (3)[BR/CM (5)]
- [x] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [x] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

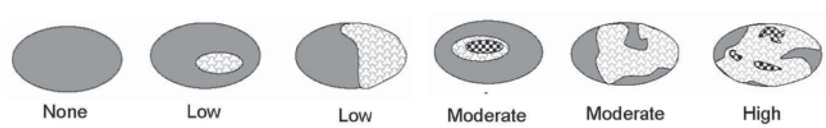
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- 0 Vegetated hummocks/tussocks
- 1 Coarse woody debris >15 cm (6 in.)
- 0 Standing dead >25 cm (10 in.) dbh
- 0 Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

34 — **GRAND TOTAL (max 100 pts)**

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: W011	Rater(s): David Nestor	Date: 5/23/2016

0	0
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- [ ] >50 acres (>20.2 ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- [ ] 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- [ ] 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- [ ] 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- [ ] 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- [x] <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

11	11
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- [ ] WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- [x] MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- [x] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- [ ] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- [ ] High. Urban, industrial, open pasture, row cropping, mining, construction (1)

10	21
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- [ ] High pH groundwater (5)
- [x] Other groundwater (3) [BR/CM (5)]
- [x] Precipitation (1) [unless BR/CM primary source (5)]
- [ ] Seasonal/intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- [ ] 100-year floodplain (1)
- [ ] Between stream/lake and other human use (1)
- [x] Part of wetland/upland (e.g., forest), complex (1)
- [ ] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- [ ] >0.7 m (27.6 in.) (3)
- [ ] 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- [x] <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3) [BR/CM (4)]
- [ ] Seasonally inundated (2) [BR/CM (4)]
- [x] Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- [ ] None or none apparent (12)
- [ ] Recovered (7)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed
- [ ] ditch
- [ ] tile (including culvert)
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other ____________________

9	30
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- [ ] None or none apparent (4)
- [ ] Recovered (3)
- [x] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [x] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.
- [ ] None or none apparent (9)
- [ ] Recovered (6)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed
- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] farming
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] woody debris removal
- [ ] sedimentation
- [ ] dredging
- [ ] nutrient enrichment

30

Site:	W011	Rater(s):	David Nestor	Date:	5/23/2016

30
subtotal previous page

max 10 pts.	subtotal
	30

raw score*:

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- ☐ Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- ☐ Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- ☐ Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- ☐ Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- ☐ Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- ☐ Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- ☐ Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- ☐ Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- ☐ Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- ☐ Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- ☐ Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

max 20 pts.	subtotal
4	34

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [0] Aquatic bed
- [1] Emergent
- [0] Shrub
- [1] Forest
- [0] Mudflats
- [0] Open water <20 acres (8 ha)
- [0] Moss/lichen. Other ______________

Vegetation Community Cover Scale

- 0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
- 1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
- 2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
- 3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- ☐ High (5)
- ☐ Moderately high (4) [BR/CM (5)]
- ☑ Moderate (3)[BR/CM (5)]
- ☐ Moderately low (2) [BR/CM (3)]
- ☐ Low (1) [BR/CM (2)]
- ☐ None (0)

Narrative Description of Vegetation Quality

- low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
- mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
- high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- ☐ Extensive >75% cover (-5)
- ☑ Moderate 25-75% cover (-3)
- ☐ Sparse 5-25% cover (-1)
- ☐ Nearly absent <5% cover (0)
- ☐ Absent (1)

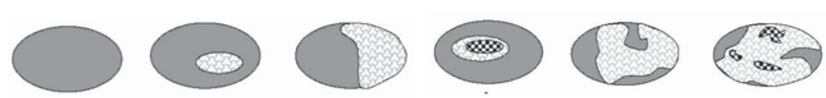
Mudflat and Open Water Class Quality

- 0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
- 1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
- 2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
- 3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [0] Vegetated hummocks/tussocks
- [1] Coarse woody debris >15 cm (6 in.)
- [0] Standing dead >25 cm (10 in.) dbh
- [1] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

- 0 = Absent
- 1 = Present in very small amounts or if more common of marginal quality
- 2 = 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 highest quality

34	**GRAND TOTAL (max 100 pts)**

- 0- 29 = Category 1, low wetland function, condition, quality**
- 30- 59 = Category 2, good/moderate wetland function, condition, quality**
- 60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site:	W012	Rater(s):	David Nestor	Date:	5/23/2016

0	0
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- [ ] >50 acres (>20.2 ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- [ ] 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- [ ] 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- [ ] 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- [ ] 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- [x] <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

11	11
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- [ ] WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- [x] MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- [x] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- [ ] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- [ ] High. Urban, industrial, open pasture, row cropping, mining, construction (1)

11	22
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- [ ] High pH groundwater (5)
- [x] Other groundwater (3) [BR/CM (5)]
- [x] Precipitation (1) [unless BR/CM primary source (5)]
- [ ] Seasonal/intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- [ ] 100-year floodplain (1)
- [ ] Between stream/lake and other human use (1)
- [x] Part of wetland/upland (e.g., forest), complex (1)
- [ ] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- [ ] >0.7 m (27.6 in.) (3)
- [ ] 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- [x] <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3) [BR/CM (4)]
- [x] Seasonally inundated (2) [BR/CM (4)]
- [ ] Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- [ ] None or none apparent (12)
- [ ] Recovered (7)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed
- [ ] ditch
- [ ] tile (including culvert)
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other ___________________

9	31
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- [ ] None or none apparent (4)
- [ ] Recovered (3)
- [x] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [x] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.
- [ ] None or none apparent (9)
- [ ] Recovered (6)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed
- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] farming
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] woody debris removal
- [ ] sedimentation
- [ ] dredging
- [ ] nutrient enrichment

31

Site: W012	Rater(s): David Nestor	Date: 5/23/2016

31
subtotal previous page

0	31
max 10 pts.	subtotal

raw score*:

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- ☐ Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- ☐ Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- ☐ Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- ☐ Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- ☐ Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- ☐ Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- ☐ Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- ☐ Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- ☐ Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- ☐ Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- ☐ Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

8	39
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- 0 Aquatic bed
- 1 Emergent
- 0 Shrub
- 2 Forest
- 0 Mudflats
- 0 Open water <20 acres (8 ha)
- 0 Moss/lichen. Other ______________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- ☐ High (5)
- ☐ Moderately high (4) [BR/CM (5)]
- ✓ Moderate (3)[BR/CM (5)]
- ☐ Moderately low (2) [BR/CM (3)]
- ☐ Low (1) [BR/CM (2)]
- ☐ None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- ☐ Extensive >75% cover (-5)
- ☐ Moderate 25-75% cover (-3)
- ✓ Sparse 5-25% cover (-1)
- ☐ Nearly absent <5% cover (0)
- ☐ Absent (1)

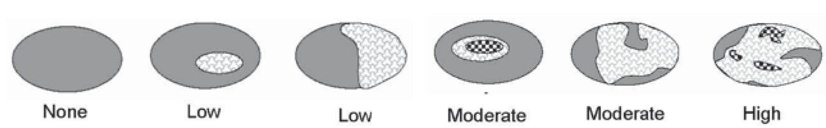
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- 0 Vegetated hummocks/tussocks
- 1 Coarse woody debris >15 cm (6 in.)
- 0 Standing dead >25 cm (10 in.) dbh
- 2 Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

39	GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: TVA, SHF W13	Rater(s): JRO, DW	Date: September 29, 2016

3	3
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☑ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☐ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

9	12
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☑ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☑ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

13	25
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☑ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☑ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☐ Seasonally inundated (2) [BR/CM (4)]
- ☑ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☑ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☑ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☑ road bed/RR track
- ☐ dredging
- ☐ other ___________________

14	39
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☑ Recovered (3)
- ☐ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☑ Very good (6)
- ☐ Good (5)
- ☐ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☑ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☑ mowing
- ☐ grazing
- ☐ clearcutting
- ☑ selective cutting
- ☑ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

39

Site: TVA, SHF W13	Rater(s): JRO, DW	Date: September 29, 2016

39
subtotal previous page

5	44
max 10 pts.	subtotal

5
raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [✓] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

15	59
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [2] Emergent
- [2] Shrub
- [2] Forest
- [ ] Mudflats
- [1] Open water <20 acres (8 ha)
- [ ] Moss/lichen. Other ______

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [✓] Moderate (3)[BR/CM (5)]
- [ ] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [✓] Nearly absent <5% cover (0)
- [ ] Absent (1)

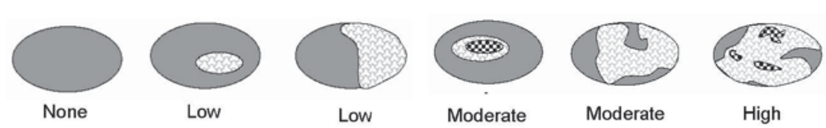
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [1] Vegetated hummocks/tussocks
- [1] Coarse woody debris >15 cm (6 in.)
- [2] Standing dead >25 cm (10 in.) dbh
- [1] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

59

GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: TVA, SHF W-14	Rater(s): JRO, DW	Date: September 29, 2016

Metric 1. Wetland Area (size)

2	2
max 6 pts.	subtotal

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- [ ] >50 acres (>20.2 ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- [ ] 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- [ ] 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- [x] 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- [ ] 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- [ ] <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

Metric 2. Upland Buffers and Surrounding Land Use

9	11
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- [ ] WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- [x] MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [x] LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- [ ] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- [ ] High. Urban, industrial, open pasture, row cropping, mining, construction (1)

Metric 3. Hydrology

13	24
max 30 pts.	subtotal

3a. Sources of water. Score all that apply.
- [ ] High pH groundwater (5)
- [x] Other groundwater (3) [BR/CM (5)]
- [x] Precipitation (1) [unless BR/CM primary source (5)]
- [ ] Seasonal/intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- [ ] 100-year floodplain (1)
- [ ] Between stream/lake and other human use (1)
- [x] Part of wetland/upland (e.g., forest), complex (1)
- [x] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- [ ] >0.7 m (27.6 in.) (3)
- [ ] 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- [x] <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3) [BR/CM (4)]
- [ ] Seasonally inundated (2) [BR/CM (4)]
- [x] Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- [ ] None or none apparent (12)
- [x] Recovered (7)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed
- [x] ditch
- [ ] tile (including culvert)
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [x] road bed/RR track
- [ ] dredging
- [ ] other ___________________

Metric 4. Habitat Alteration and Development

11	35
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.
- [ ] None or none apparent (4)
- [x] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- [ ] Excellent (7)
- [ ] Very good (6)
- [x] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.
- [ ] None or none apparent (9)
- [ ] Recovered (6)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed
- [x] mowing
- [ ] grazing
- [ ] clearcutting
- [x] selective cutting
- [x] farming
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] woody debris removal
- [ ] sedimentation
- [ ] dredging
- [ ] nutrient enrichment

35

Site: TVA, SHF W-14	Rater(s): JRO, DW	Date: September 29, 2016

35
subtotal previous page

5	40
max 10 pts.	subtotal

5
raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [x] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

10	50
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [1] Shrub
- [2] Forest
- [ ] Mudflats
- [ ] Open water <20 acres (8 ha)
- [ ] Moss/lichen. Other ______________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [ ] Moderate (3)[BR/CM (5)]
- [x] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [x] Nearly absent <5% cover (0)
- [ ] Absent (1)

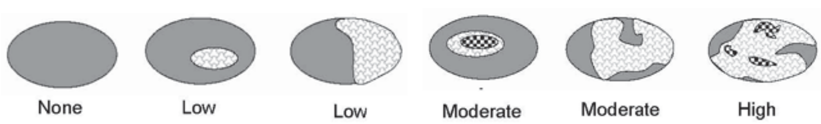
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [1] Vegetated hummocks/tussocks
- [1] Coarse woody debris >15 cm (6 in.)
- [2] Standing dead >25 cm (10 in.) dbh
- [ ] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

50	**GRAND TOTAL (max 100 pts)**

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: TVA, SHF W-15	Rater(s): JRO, DW	Date: October 4, 2016

2	2
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☑ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

9	11
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☑ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☑ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

7	18
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☐ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☐ Seasonally inundated (2) [BR/CM (4)]
- ☑ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☑ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☑ road bed/RR track
- ☐ dredging
- ☐ other ___________________

10	28
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☑ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☑ Good (5)
- ☐ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☑ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☑ selective cutting
- ☐ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

28

Site: TVA, SHF W-15	Rater(s): JRO, DW	Date: October 4, 2016

28
subtotal previous page

5	33
max 10 pts.	subtotal

5
raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [✓] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

12	45
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [1] Shrub
- [2] Forest
- [ ] Mudflats
- [ ] Open water <20 acres (8 ha)
- [ ] Moss/lichen. Other ______________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [✓] Moderate (3)[BR/CM (5)]
- [ ] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [✓] Nearly absent <5% cover (0)
- [ ] Absent (1)

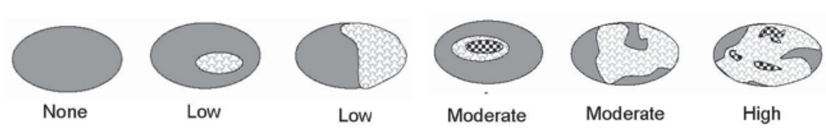
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [1] Vegetated hummocks/tussocks
- [2] Coarse woody debris >15 cm (6 in.)
- [2] Standing dead >25 cm (10 in.) dbh
- [ ] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

45

GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: TVA, SHF W-16	Rater(s): JRO, DW	Date: October 4, 2016

3	3
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- [ ] >50 acres (>20.2 ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- [ ] 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- [x] 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- [ ] 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- [ ] 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- [ ] <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

9	12
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- [ ] WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- [x] MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [x] LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- [ ] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- [ ] High. Urban, industrial, open pasture, row cropping, mining, construction (1)

10	22
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- [ ] High pH groundwater (5)
- [ ] Other groundwater (3) [BR/CM (5)]
- [x] Precipitation (1) [unless BR/CM primary source (5)]
- [x] Seasonal/intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- [ ] 100-year floodplain (1)
- [ ] Between stream/lake and other human use (1)
- [x] Part of wetland/upland (e.g., forest), complex (1)
- [ ] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- [ ] >0.7 m (27.6 in.) (3)
- [x] 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- [ ] <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- [ ] Semi- to permanently inundated/saturated (4)
- [x] Regularly inundated/saturated (3) [BR/CM (4)]
- [ ] Seasonally inundated (2) [BR/CM (4)]
- [x] Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- [ ] None or none apparent (12)
- [ ] Recovered (7)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed
- [x] ditch
- [ ] tile (including culvert)
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [x] road bed/RR track
- [ ] dredging
- [ ] other ___________________

13	35
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- [ ] None or none apparent (4)
- [ ] Recovered (3)
- [x] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- [ ] Excellent (7)
- [x] Very good (6)
- [ ] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.
- [ ] None or none apparent (9)
- [x] Recovered (6)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed
- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [x] selective cutting
- [ ] farming
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] woody debris removal
- [ ] sedimentation
- [ ] dredging
- [ ] nutrient enrichment

35

Site: TVA, SHF W-16	Rater(s): JRO, DW	Date: October 4, 2016

35
subtotal previous page

5	40
max 10 pts.	subtotal

5
raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [✓] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only “historic”]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

15	55
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [2] Shrub
- [2] Forest
- [1] Mudflats
- [1] Open water <20 acres (8 ha)
- [ ] Moss/lichen. Other ______

Vegetation Community Cover Scale

0 =	Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 =	Present and either comprises a small part of wetland’s vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 =	Present and either comprises a significant part of wetland’s vegetation and is of moderate quality, or comprises a small part and is of high quality
3 =	Present and comprises a significant part or more of wetland’s vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [✓] Moderate (3)[BR/CM (5)]
- [ ] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low =	Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod =	Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high =	A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [✓] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

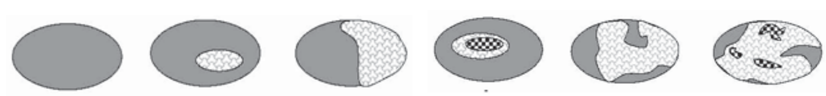
Mudflat and Open Water Class Quality

0 =	Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 =	Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 =	Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 =	High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [1] Vegetated hummocks/tussocks
- [2] Coarse woody debris >15 cm (6 in.)
- [2] Standing dead >25 cm (10 in.) dbh
- [1] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 =	Absent
1 =	Present in very small amounts or if more common of marginal quality
2 =	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 highest quality

55

GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: TVA, SHF W-17	Rater(s): JRO, DW	Date: Oct, 4, 2016

2	2
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☑ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

6	8
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☑ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☑ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☑ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

20	28
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☐ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☑ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☑ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☑ Seasonally inundated (2) [BR/CM (4)]
- ☐ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☑ Recovered (7)
- ☐ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ___________________

12	40
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☑ Recovered (3)
- ☐ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☐ Moderately good (4)
- ☑ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☑ Recovered (6)
- ☐ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☐ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

40

Site: TVA, SHF W-17	**Rater(s):** JRO, DW	**Date:** Oct, 4, 2016

40
subtotal previous page

5	45
max 10 pts.	subtotal

5
raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- ☐ Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- ☑ Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- ☐ Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- ☐ Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- ☐ Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- ☐ Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- ☐ Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- ☐ Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- ☐ Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- ☐ Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- ☐ Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

7	52
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- ☐ Aquatic bed
- ☐ Emergent
- 1 Shrub
- 2 Forest
- ☐ Mudflats
- ☐ Open water <20 acres (8 ha)
- ☐ Moss/lichen. Other ______________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- ☐ High (5)
- ☐ Moderately high (4) [BR/CM (5)]
- ☐ Moderate (3)[BR/CM (5)]
- ☑ Moderately low (2) [BR/CM (3)]
- ☐ Low (1) [BR/CM (2)]
- ☐ None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- ☐ Extensive >75% cover (-5)
- ☐ Moderate 25-75% cover (-3)
- ☐ Sparse 5-25% cover (-1)
- ☑ Nearly absent <5% cover (0)
- ☐ Absent (1)

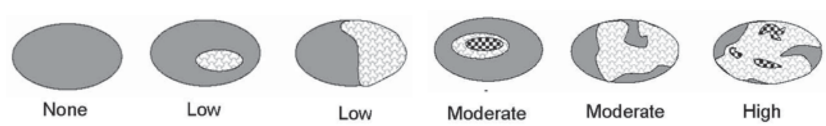
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- ☐ Vegetated hummocks/tussocks
- 1 Coarse woody debris >15 cm (6 in.)
- 1 Standing dead >25 cm (10 in.) dbh
- ☐ Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

52

GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: TVA, SHF W-18	Rater(s): JRO, DW	Date: 11.2.2016

2	2
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☑ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

5	7
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☐ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☑ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☑ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

19	26
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☐ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☑ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☐ Part of wetland/upland (e.g., forest), complex (1)
- ☑ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☑ Seasonally inundated (2) [BR/CM (4)]
- ☐ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☑ Recovered (7)
- ☐ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other farming

12	38
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☑ Recovered (3)
- ☐ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☐ Moderately good (4)
- ☑ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☑ Recovered (6)
- ☐ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☐ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

38

Site: TVA, SHF W-18	**Rater(s):** JRO, DW	**Date:** 11.2.2016

38
subtotal previous page

0	38
max 10 pts.	subtotal

0
raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [ ] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

7	45
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [ ] Emergent
- [1] Shrub
- [2] Forest
- [ ] Mudflats
- [ ] Open water <20 acres (8 ha)
- [ ] Moss/lichen. Other ______________

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [ ] Moderate (3)[BR/CM (5)]
- [x] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [x] Nearly absent <5% cover (0)
- [ ] Absent (1)

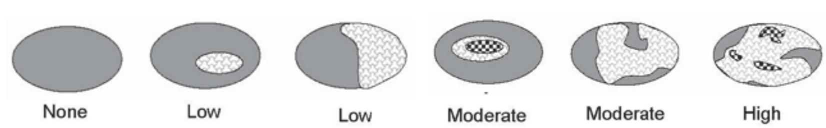
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [ ] Vegetated hummocks/tussocks
- [1] Coarse woody debris >15 cm (6 in.)
- [1] Standing dead >25 cm (10 in.) dbh
- [ ] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

45

GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Site: TVA, SHF W-19	Rater(s): JRO, DW	Date: 11.2.2016

2	2
max 6 pts.	subtotal

Metric 1. Wetland Area (size)

Notes: BR/CM = adjusted points for Blue Ridge and Cumberland Mountains. If an open water body (excluding aquatic beds and seasonal mudflats) is >20 acres (8 ha), then add only 0.5 acre (0.2 ha) of it to the wetland size for Metric 1.

Select one size class and assign score.
- ☐ >50 acres (>20.2 ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2 ha) (5) [BR/CM (6)]
- ☐ 10 to <25 acres (4 to <10.1 ha) (4) [BR/CM (6)]
- ☐ 3 to <10 acres (1.2 to <4 ha) (3) [BR/CM (5)]
- ☑ 0.3 to <3 acres (0.1 to <1.2 ha) (2) [BR/CM (3)]
- ☐ 0.1 to <0.3 acre (0.04 to <0.1 ha) (1) [BR/CM (2)]
- ☐ <0.1 acre (0.04 ha) (0)

Sources/assumptions for size estimate (list):

9	11
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use

2a. Calculate average buffer width. Select only one and assign score. Do not double check.
- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☑ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.
- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☑ LOW. Old field (>10 years), shrubland, young 2nd growth forest (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field (3)
- ☐ High. Urban, industrial, open pasture, row cropping, mining, construction (1)

13	24
max 30 pts.	subtotal

Metric 3. Hydrology

3a. Sources of water. Score all that apply.
- ☐ High pH groundwater (5)
- ☐ Other groundwater (3) [BR/CM (5)]
- ☑ Precipitation (1) [unless BR/CM primary source (5)]
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.
- ☐ 100-year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☑ Part of wetland/upland (e.g., forest), complex (1)
- ☑ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.
- ☐ >0.7 m (27.6 in.) (3)
- ☐ 0.4 to 0.7 m (16 to 27.6 in.) (2) [BR/CM (3)]
- ☑ <0.4 m (<16 in.) (1) [BR/CM 0.15 to 0.4 m (6 to <16 in.) (2)]

3d. Duration inundation/saturation. Score one or dbl. check & avg.
- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3) [BR/CM (4)]
- ☑ Seasonally inundated (2) [BR/CM (4)]
- ☐ Seasonally saturated in upper 30 cm (12 in.) (1) [BR/CM (2)]

3e. Modifications to natural hydrologic regime. Score one or double check and average.
- ☐ None or none apparent (12)
- ☑ Recovered (7)
- ☐ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☐ ditch
- ☐ tile (including culvert)
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other ____________________

12	36
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development

4a. Substrate disturbance. Score one or double check and average.
- ☐ None or none apparent (4)
- ☑ Recovered (3)
- ☐ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.
- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☐ Moderately good (4)
- ☑ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.
- ☐ None or none apparent (9)
- ☑ Recovered (6)
- ☐ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed
- ☑ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☑ farming
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ woody debris removal
- ☐ sedimentation
- ☐ dredging
- ☐ nutrient enrichment

36

Site: TVA, SHF W-19	Rater(s): JRO, DW	Date: 11.2.2016

36
subtotal previous page

5	41
max 10 pts.	subtotal

5
raw score*

Metric 5. Special Wetlands

*If the documented raw score for Metric 5 is 30 points or higher, the site is automatically considered a Category 3 wetland.

Select all that apply. Where multiple values apply in row, score row as single feature with highest point value. Provide documentation for each selection (photos, checklists, maps, resource specialist concurrence, data sources, references, etc).

- [ ] Bog, fen, wet prairie (10); acidophilic veg., mossy substrate >10 sq.m, sphagnum or other moss (5); muck, organic soil layer (3)
- [✓] Assoc. forest (wetl. &/or adj. upland) incl. >0.25 acre (0.1 ha); old growth (10); mature >18 in. (45 cm) dbh (5) [exclude pine plantation]
- [ ] Sensitive geologic feature such as spring/seep, sink, losing/underground stream, cave, waterfall, rock outcrop/cliff (5)
- [ ] Vernal pool (5); isolated, perched, or slope wetland (4); headwater wetland [1st order perennial or above] (3)
- [ ] Island wetland >0.1 acre (0.04 ha) in reservoir, river, or perennial water >6 ft (2 m) deep (5)
- [ ] Braided channel or floodplain/terrace depressions (floodplain pool, slough, oxbow, meander scar, etc.) (3)
- [ ] Gross morph. adapt. in >5 trees >10 in. (25 cm) dbh: buttress, multitrunk/stool, stilted, shallow roots/tip-up, or pneumatophores (3)
- [ ] Ecological community with global rank (NatureServe): G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier]
- [ ] Known occurrence state/federal threatened/endangered species (10); other rare species with global rank G1*(10), G2*(5), G3*(3) [*use higher rank where mixed rank or qualifier] [exclude records which are only "historic"]
- [ ] Superior/enhanced habitat/use: migratory songbird/waterfowl (5); in-reservoir buttonbush (4); other fish/wildlife management/designation (3)
- [ ] Cat. 1 (very low quality) : <1 acre (0.4 ha) AND EITHER >80% cover of invasives OR nonvegetated on mined/excavated land (-10)

6	47
max 20 pts.	subtotal

Metric 6. Plant Communities, Interspersion, Microtopography

6a. Wetland vegetation communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [2] Emergent
- [ ] Shrub
- [ ] Forest
- [ ] Mudflats
- [1] Open water <20 acres (8 ha)
- [ ] Moss/lichen. Other ______

Vegetation Community Cover Scale

0 = Absent or <0.1 ha (0.25 acre) contiguous acre [For BR/CM <0.04 ha (0.1 acre)]
1 = Present and either comprises a small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2 = Present and either comprises a significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3 = Present and comprises a significant part or more of wetland's vegetation and is of high quality

6b. Horizontal (plan view) interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high (4) [BR/CM (5)]
- [ ] Moderate (3)[BR/CM (5)]
- [✓] Moderately low (2) [BR/CM (3)]
- [ ] Low (1) [BR/CM (2)]
- [ ] None (0)

Narrative Description of Vegetation Quality

low = Low species diversity &/or dominance of nonnative or disturbance tolerant native species
mod = Native species are dominant component of the vegetation, although nonnative &/or disturbance tolerant native species can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare, threatened or endangered species
high = A predominance of native species with nonnative sp &/or disturbance tolerant native sp absent or virtually absent, and high sp diversity and often but not always, the presence of rate, threatened, or endangered species

6c. Coverage of invasive plants.
Add or deduct points for coverage.

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [✓] Nearly absent <5% cover (0)
- [ ] Absent (1)

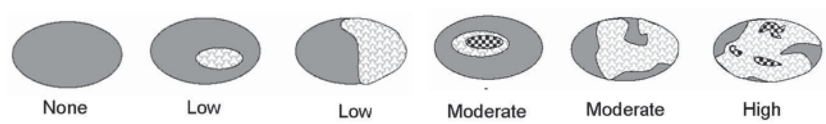
Mudflat and Open Water Class Quality

0 = Absent <0.1 ha (0.25 acres) [For BR/CM <0.04 ha (0.1 acre)]
1 = Low 0.1 to <1 ha (0.25 to 2.5 acres) [BR/CM 0.04 to <0.2 ha (0.1 to 0.5 acre)]
2 = Moderate 1 to <4 ha (2.5 to 9.9 acres) [BR/CM 0.2 to <02 ha (0.5 to 5 acre)]
3 = High 4 ha (9.9 acres) or more [BR/CM 2 ha (5 acres) or more]

6d. Microtopography.
Score all present using 0 to 3 scale.

- [ ] Vegetated hummocks/tussocks
- [ ] Coarse woody debris >15 cm (6 in.)
- [ ] Standing dead >25 cm (10 in.) dbh
- [1] Amphibian breeding pools

Hypothetical Wetland for Estimating Degree of Interspersion



Microtopography Cover Scale

0 = Absent
1 = Present in very small amounts or if more common of marginal quality
2 = 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 highest quality

47

GRAND TOTAL (max 100 pts)

0- 29 = Category 1, low wetland function, condition, quality**
30- 59 = Category 2, good/moderate wetland function, condition, quality**
60-100 = Category 3, superior wetland function, condition, quality**

**Based on ORAM Score Calibration Report for the scoring breakpoints between wetland categories: http://www.epa.state.oh.us/dsw/401/401.html

Attachment 2
Photo-Log

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No. 1	Date: 9/29/16

Direction Photo Taken:

NW

Description:

Pond 1, W-8

Photo No. 2	Date: 9/29/16

Direction Photo Taken:

Description:

W7-1 soil

AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No.	Date:
3	9/29/16

Direction Photo Taken:

Description:

UPL 7-1 soil

Photo No.	Date:
4	9/29/16

Direction Photo Taken:

Northeast

Description:

UPL7-1

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No.	Date:
5	9/29/16

Direction Photo Taken:

Description:

UPL 7-2

Photo No.	Date:
6	9/29/16

Direction Photo Taken:

north

Description:

North end of W-13

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No. 7 **Date:** 9/29/16

Direction Photo Taken:

east

Description:

East end of W-14

Photo No. 8 **Date:** 9/29/16

Direction Photo Taken:

west

Description:

Pond – 7 connected to W-13

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No.	Date:
9	9/29/16

Direction Photo Taken:

North west

Description:

PUB-3

Photo No.	Date:
10	10/04/16

Direction Photo Taken:

west

Description:

W-15

AECOM

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Paradise	Proposed landfill site	60478473

Photo No.	Date:
11	10/04/16

Direction Photo Taken:

east

Description:

W-16 and PUB - 6

Photo No.	Date:
12	10/04/16

Direction Photo Taken:

south

Description:

Upland to the SW of photo 11 and W-16

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No. 13 **Date:** 10/04/16

Direction Photo Taken:

southeast

Description:

PUB-4

Photo No. 14 **Date:** 10/04/16

Direction Photo Taken:

northwest

Description:

WWC-2

	PHOTOGRAPHIC LOG

Client Name:	**Site Location:**	**Project No.**
TVA Shawnee	Proposed landfill site	60515229

Photo No. 15	**Date:** 10/04/16
Direction Photo Taken: east	
Description: Stream -1	

Photo No. 16	**Date:** 10/04/16
Direction Photo Taken: south	
Description: Stream 2	

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Shawnee	Proposed landfill site	60515229

Photo No.	Date:
17	10/04/16

Direction Photo Taken:

east

Description:

W -13

Photo No.	Date:
18	10/04/16

Direction Photo Taken:

northeast

Description:

W-7-3

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Paradise	Proposed landfill site	60478473

Photo No.	Date:
19	11/02/16

Direction Photo Taken:

north

Description:

W-11

Photo No.	Date:
20	11/02/16

Direction Photo Taken:

north

Description:

PUB-8

AECOM	PHOTOGRAPHIC LOG	
Client Name: TVA Paradise	**Site Location:** Proposed landfill site	**Project No.** 60478473

Photo No. 21	**Date:** 11/02/16

Direction Photo Taken:

east

Description:

East end of W-16

Photo No. 22	**Date:** 11/02/16

Direction Photo Taken:

north

Description:

W-16

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
TVA Paradise	Proposed landfill site	60478473

Photo No.	Date:
23	10/04/16

Direction Photo Taken:

southeast

Description:

North end of W-19 facing SE

Photo No.	Date:
24	11/02/16

Direction Photo Taken:

Description:

W-19 soils

Appendix E – Visual Resources Analysis

Appendix E – Visual Resources Analysis

SHF Proposed Dry CCR Landfill Visual Resources Analysis

A visual resources analysis was conducted to determine existing conditions at the proposed dry CCR landfill site and to evaluate potential impacts associated with the proposed action. Figure 1 shows the 12 key observation points photographed and evaluated for potential impacts.

Photo Location 1 Existing is the intersection of Shawnee Lane and Metropolis Lake Road, facing northwest. The photo shows the landfill project site and the intersection with a dense row of trees blocking the view of the site. Rendering Location 1 Build shows the outline of the proposed landfill behind the trees. The new CCR landfill would not be visible from this location if the existing screening roadside trees were to be left in place.

Photo Location 2 Existing is from farther south on Metropolis Lake Road, facing north-northwest. The view shows the existing trees on the site and along the road with one of the SHF stacks visible in the far distance. The scenic integrity is moderate, showing a rural landscape with natural colors. An observer would appreciate this view when travelling past. Rendering Location 2 Build (With Tree Buffer) shows the appearance of the proposed dry CCR landfill through a row of screening trees on the road side. The landfill itself is just barely visible beneath the tree canopies on the right of the rendering. The view is different from the existing scene, but not jarring or uncharacteristic of the surrounding area. From this angle, the landfill is almost not visible. Depending on the species of tree, with respect to evergreen or deciduous and future growth patterns, the view may change with the season and over time. If the trees are deciduous, the winter scene would show the landfill considerably more than this rendering. A lack of tree canopy would create a somewhat disjointed view. The landfill, however, is recessed considerably from the road and would not be a major focal point. Similar impacts could occur if the screening tree species developed a tall trunk with few branches at the bottom. The landfill would become more visible over time. Overall, however, impacts to visual resources at this location would be minimal, as the tree screen would effectively block observers from directly viewing the landfill.

Photo Location 3 Existing is the intersection of Metropolis Lake Road and Steam Plant Road, facing southwest. The scene is rural and agricultural, showing a field and farm buildings along a single lane winding road. Rendering Location 3 Build shows that the proposed landfill is not visible from this location. Therefore, from this location, the proposed landfill would not create impacts to visual resources.

Photo Location Existing 4 is on Carneal Road between Tucker Road and Metropolis Lake Road, facing northwest. The view is similar to the previous photo locations, showing agricultural fields in the foreground, trees in the middleground and the SHF stacks in the far background. The scene is typical of a rustic area. Rendering Location 4 Build shows the outline of the proposed landfill, which is hidden by the trees in the middleground. From this location, there would be no direct negative impacts to visual resources as no changes to the viewshed would occur.

Photo Location 5 Existing is the corner of Carneal Road and Metropolis Lake Road, facing north. The view is of a small country road with trees along it. Some small farm buildings are also visible in the middleground. Rendering Location 5 Build shows the proposed landfill with a row of screening trees in front of it. The landfill is just barely visible behind the existing road side trees. As with Rendering Location 2 Build , the view could differ depending on the tree species both by season and over time. However, the observer is so far from the actual landfill it is not likely to become a major focal point. From this location there would be minor and insignificant negative impacts to visual resources as the landfill would be hidden by the existing vegetation and the row of screening trees.

Photo Location 6 Existing is in Metropolis, across the Ohio River, to the east of the train trestle bridge. This view is industrial in nature due to the expansive parking lot and train bridge. The parking lot appears to be being used as a staging area for a construction project. The scene consists of many manmade objects with little scenic integrity other than the engineering design of the bridge itself. Rendering Location 6 Build shows the outline of the proposed landfill, which is hidden behind the sparse trees and the bridge. From this location there would be no negative impacts to visual resources.

Photo Location 7 Existing is Fort Massac State Park, facing west. The view is of the Ohio River bank with the Fort to the right and the Kentucky side of the bank in the distance. The large body of water with speckled sun spots would make an observer feel tranquility and harmony. The lack of manmade objects or their visual obscurity due to size or screening creates a sense of the surrounding natural environment. Rendering Location 7 Build shows the outline of the proposed landfill which would not be visible from this vantage point. Therefore, from this location, negative impacts to visual resources would not occur.

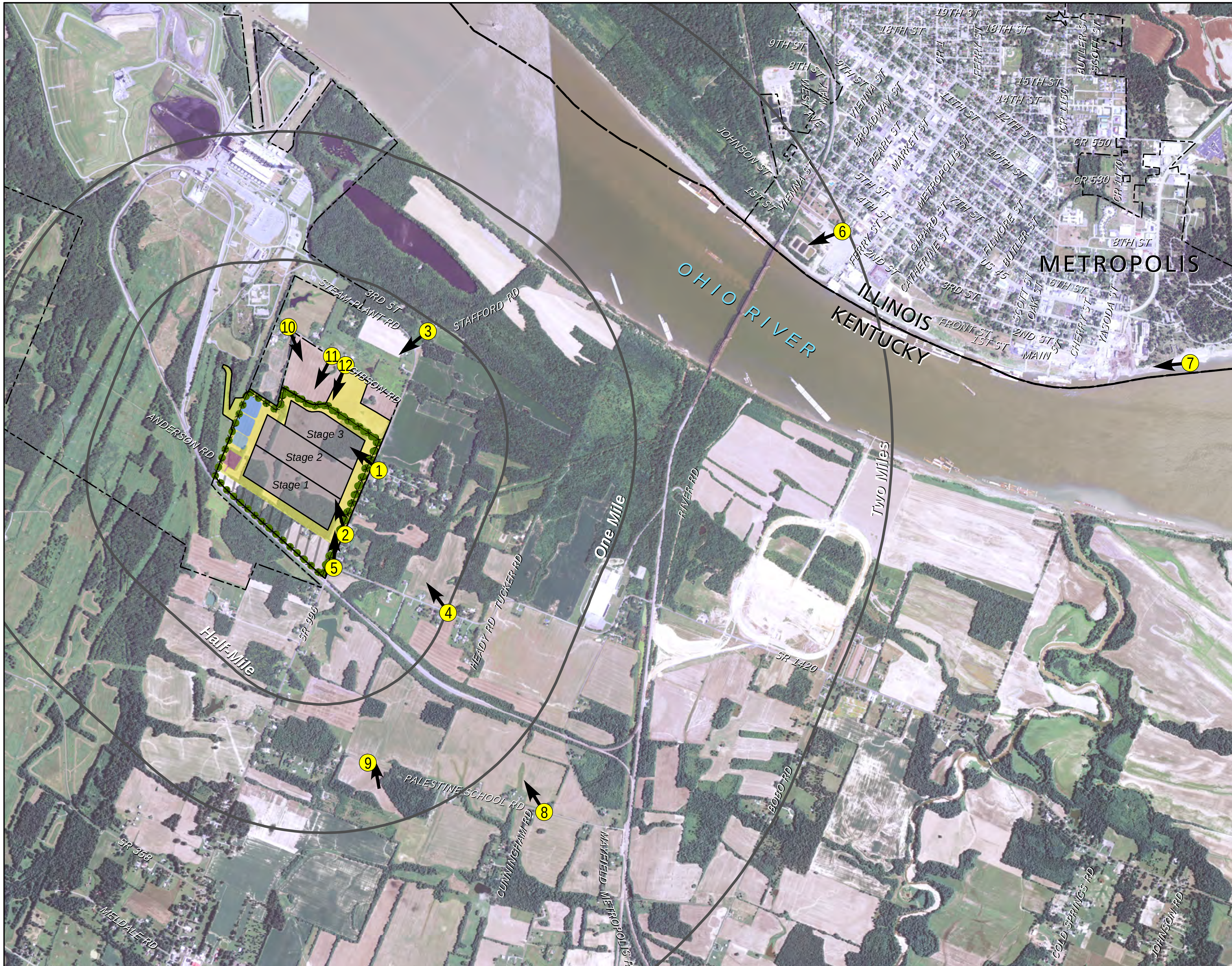
Photo Location 8 Existing is the intersection of Palestine School Road and Cunningham Road facing northwest. Rendering Location 8 Build shows the outline of the proposed landfill, which is hidden by intervening trees. Photo Location 9 Existing is farther northwest on Palestine School Road. Rendering Location 9 Build shows the proposed landfill outline. The landfill is also not visible from this location due to intervening trees. Negative impacts to visual resources from these two locations would not occur due to the existing screening vegetation.

Photo Location 10 Existing is on Gipson Road near the northwest corner of the proposed dry CCR landfill, facing southeast towards the landfill. The existing view is of a thin roadside treeline with agricultural fields in the background. The scene is a typical rural area, with small houses and large fields common to the area. Rendering Location 10 Build shows the proposed landfill behind the trees. The landfill is somewhat hidden by the trees, but it can be seen as a large hill immediately behind them. This rendering shows the landfill as it would be once this section is filled and re-vegetated. During the active stages of the landfill in this area, it would appear as a brown mass instead of green. Additionally, the equipment would be visible during operations. The landfill at the completion stage is not visually obtrusive due to its color and the intervening trees. However, at this location there would be direct and indirect impacts to visual resources because the viewshed would change from rural agricultural to moderately industrial altering the aesthetic character. From this location, the impacts to visual resources would be considered moderate due to the proximity, size and visual character of the new landfill and the effects of large equipment during operations.

Photo Location 11 Existing is from in front of a residence at on Gipson Road, facing the proposed dry CCR landfill site. The existing scene is agricultural and open, with fields and trees dividing the fields. It shows a representative view of a rural landscape. Rendering Location 11 Build shows the appearance of the proposed landfill without a tree screen. The trees in the background have either been removed or obscured and replaced with a large hill, which obstructs any potential background views. This is a drastic change in the visual environment as seen from this location. The impacts are much more obvious to the observer from this location due to the lack of intervening trees. The entire viewshed has been altered from a rural setting to an industrial one. At this location, impacts to visual resources would be large without mitigation. Rendering Location 11 Build (With Tree Buffer) shows the proposed landfill with a tree screen. Although this view is less drastic than the previous rendering, the landfill is still a focal point in the viewshed. Potentially, overtime, as the screening trees grow, it would become less obtrusive. However, also depending on the species of trees, it could appear as in Rendering 11 Build during the winter. Negative impacts to visual resources at this location would also occur during operations as large earthmoving equipment would be present in addition to the large mound of earth. Therefore, at this location, with the planting of a tree screen, moderate negative impacts to visual resources would occur due to the proximity of the potential observers and the size and focus of the visual changes.

Photo Location 12 Existing is from another residence on Gipson Road, adjacent to Location 11. Impacts to visual resources would be similar to those at Location 11 (see Renderings Location 12 Build and Location 12 Build (With Tree Buffer)). A dramatic change in the view would result from the transformation of an agricultural field into a landfill. This change would also be perceived more strongly due to the remainder of the local area still appearing rural.

Overall, the impacts to visual resources due to the construction and operation of the proposed landfill would be moderate, due to the low density of residents and travelers. The largest impacts would be to the residents on Gibson Road. Even with the proposed tree screen, impacts at these locations would be significant, although moderate. At the other locations investigated there would be no or only minor insignificant negative impacts to visual resources due to tree screens, existing vegetation and distance from the landfill.



M:\work\TVA_Shawnee_KY\Photo_Locations_Feb17.mxd 3/9/2017 9:11:03 AM

AECOM

- 1 Photo Location and Location Id.
- Fence
- Property Line
- Tree Buffer
- Ancillary Facility
- Leachate Pond
- New Dry CCR Landfill Project Area
- Landfill Stages
- Stormwater Pond
- Temporary Construction

Base map data supplied by Esri and USDA Farm Service Agency NAIP program. Date of photo: 2014.

Photo Locations

TVA Shawnee Fossil Plant
Proposed New CCR Landfill

0 1,000 2,000 4,000 Feet

Location 1 Existing

Location 1 Build Condition Obscured by Trees (Outline Shown)

Location 2 Existing


Location 2 Build (with Perimeter Tree Buffer)


Location 3 Existing


Location 3 Build

Location 4 Existing

Location 4 Build Condition Obscured by Trees (Outline Shown)

Location 5 Existing

Location 5 Build

Location 6 Existing

Location 6 Build Condition Obscured by Trees (Outline Shown)

Location 7 Existing

Location 7 Build Condition Obscured by Trees (Outline Shown)

Location 8 Existing

Location 8 Build Condition Obscured by Trees (Outline Shown)


Location 9 Existing

Location 9 Build Condition Obscured by Trees (Outline Shown)

Location 10 Existing

Location 10 Build

Location 11 Existing

Location 11 Build

Location 11 Build (With Tree Buffer)

Location 12 Existing

Location 12 Build

Location 12 Build (With Tree Buffer)

Appendix F – Agency Consultation

Appendix F –Agency Consultation

AECOM
10 Patewood Drive, Bldg. VI, Suite 500
Greenville, SC 29615

864.234.3000 tel
864.234.3069 fax

February 16, 2017

Mr. Steve Blanford
State Soil Scientist
Natural Resources Conservation Service
771 Corporate Drive
Suite 300
Lexington, KY 40503

SUBJECT: Request for Farmland Conversion Impact Rating – Shawnee Fossil Plant Proposed New Dry Coal Combustion Residuals (CCR) Landfill

Dear Mr. Blanford,

AECOM is working with the Tennessee Valley Authority (TVA) (Ashley Pilakowski, 865-632-2256) in the preparation of an Environmental Impact Statement management of coal combustion residuals (CCR) at TVA's Shawnee Fossil Plant (SHF) near Paducah, Kentucky. The proposed project includes the closure of Ash Impoundment 2 and the existing Special Waste Landfill at SHF and either a) the construction and operation of a new dry CCR landfill on another portion of the SHF property, or b) the transport of CCR to an existing permitted landfill. The proposed new dry CCR landfill would be located on approximately 238 acres of TVA owned land at SHF (Figure 1).

TVA is in the process of conducting investigations and preparing the NEPA compliance documentation for the proposed project. This documentation will include a comprehensive analysis of pertinent environmental impacts, including prime or unique farmlands and an analysis of project alternatives. This letter is being submitted under the provisions of the Farmland Protection Policy Act.

TVA purchased part of the 238 acre proposed new dry CCR landfill site in 2016. Prior to that time, at least portions of the property were in agricultural land use. The site would be used first to provide borrow material for the closure of Ash Impoundment 2 and the existing Special Waste Landfill and then for construction and operation of a new dry CCR landfill.

Enclosed is Form AD-1006, the Farmland Conversion Impact Rating Form, with Parts I and III completed and a map showing soil types and farmland classification of the proposed project site (Figure 2). To ensure compliance with the Farmland Protection Policy Act and to support the NEPA process, TVA requests that Natural Resources Conservation Service review the enclosed project-specific information and complete Parts II, IV, and V on the enclosed Form AD-1006. TVA staff will forward to your office, through the Kentucky Clearinghouse, a copy of the draft NEPA document, when it is available for distribution, along with a request for comments.

If you have any questions regarding this proposed project, please contact me at 864-234-8913 (bobbie.hurley@aecom.com) or Ashley Pilakowski at 865-632-2256 (aapilakowski@tva.gov).

Sincerely,

Roberta A. Hurley
Project Manager

Figure 1. SHF Proposed Action Locations within SHF Property

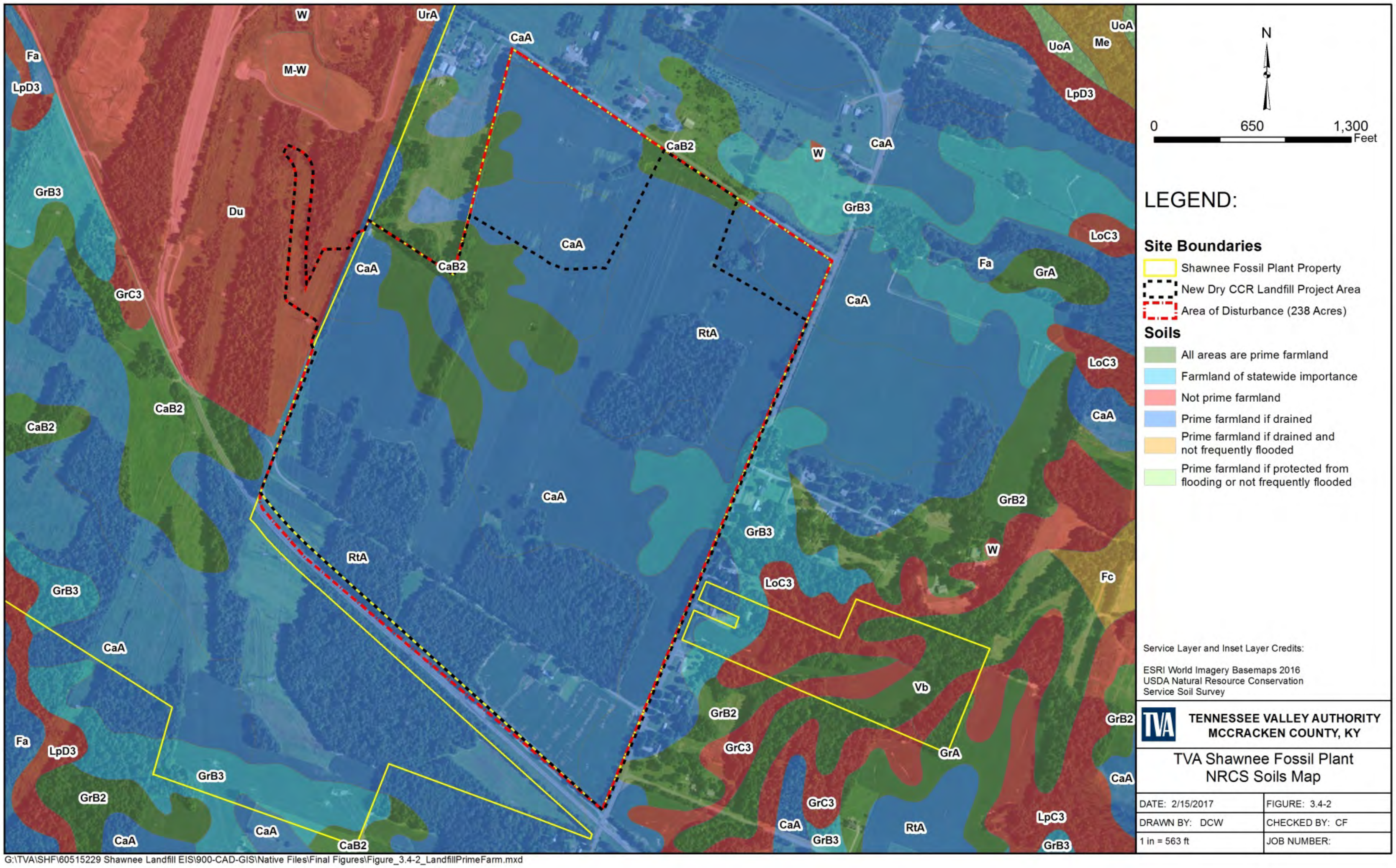


Figure 2. Prime Farmland Soils at the Proposed New Dry CCR Landfill Site

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 02/15/2017
Name of Project SHF CCR Management EIS	Federal Agency Involved Tennessee Valley Authority
Proposed Land Use New Dry CCR Landfill	County and State McCracken County, Kentucky

PART II *(To be completed by NRCS)*	Date Request Received By NRCS	Person Completing Form:

Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☐	NO ☐	Acres Irrigated	Average Farm Size

Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %	Amount of Farmland As Defined in FPPA Acres: %
Name of Land Evaluation System Used	Name of State or Local Site Assessment System	Date Land Evaluation Returned by NRCS

PART III *(To be completed by Federal Agency)*		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		238			
B. Total Acres To Be Converted Indirectly		0			
C. Total Acres In Site		238			
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland					
B. Total Acres Statewide Important or Local Important Farmland					
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted					
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value					
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)					
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)	15			
2. Perimeter In Non-urban Use	(10)	10			
3. Percent Of Site Being Farmed	(20)	15			
4. Protection Provided By State and Local Government	(20)	0			
5. Distance From Urban Built-up Area	(15)	13			
6. Distance To Urban Support Services	(15)	0			
7. Size Of Present Farm Unit Compared To Average	(10)	10			
8. Creation Of Non-farmable Farmland	(10)	10			
9. Availability Of Farm Support Services	(5)	4			
10. On-Farm Investments	(20)	6			
11. Effects Of Conversion On Farm Support Services	(10)	0			
12. Compatibility With Existing Agricultural Use	(10)	5			
TOTAL SITE ASSESSMENT POINTS	160	88	0	0	0
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	0	0	0	0
Total Site Assessment *(From Part VI above or local site assessment)*	160	88	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	88	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐

Reason For Selection:

Name of Federal agency representative completing this form:	Date:

(See Instructions on reverse side) **Form AD-1006 (03-02)**

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 - Federal agencies (or Federally funded projects) involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form. For Corridor type projects, the Federal agency shall use form NRCS-CPA-106 in place of form AD-1006. The Land Evaluation and Site Assessment (LESA) process may also be accessed by visiting the FPPA website, http://fppa.nrcs.usda.gov/lesa/.

Step 2 - Originator (Federal Agency) will send one original copy of the form together with appropriate scaled maps indicating location(s)of project site(s), to the Natural Resources Conservation Service (NRCS) local Field Office or USDA Service Center and retain a copy for their files. (NRCS has offices in most counties in the U.S. The USDA Office Information Locator may be found at http://offices.usda.gov/scripts/ndISAPI.dll/oip_public/USA_map, or the offices can usually be found in the Phone Book under U.S. Government, Department of Agriculture. A list of field offices is available from the NRCS State Conservationist and State Office in each State.)

Step 3 - NRCS will, within 10 working days after receipt of the completed form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland. (When a site visit or land evaluation system design is needed, NRCS will respond within 30 working days.

Step 4 - For sites where farmland covered by the FPPA will be converted by the proposed project, NRCS will complete Parts II, IV and V of the form.

Step 5 - NRCS will return the original copy of the form to the Federal agency involved in the project, and retain a file copy for NRCS records.

Step 6 - The Federal agency involved in the proposed project will complete Parts VI and VII of the form and return the form with the final selected site to the servicing NRCS office.

Step 7 - The Federal agency providing financial or technical assistance to the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

(For Federal Agency)

Part I: When completing the "County and State" questions, list all the local governments that are responsible for local land use controls where site(s) are to be evaluated.

Part III: When completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them or other major change in the ability to use the land for agriculture.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities planned build out capacity) that will cause a direct conversion.

Part VI: Do not complete Part VI using the standard format if a State or Local site assessment is used. With local and NRCS assistance, use the local Land Evaluation and Site Assessment (LESA).

1. Assign the maximum points for each site assessment criterion as shown in § 658.5(b) of CFR. In cases of corridor-type project such as transportation, power line and flood control, criteria #5 and #6 will not apply and will, be weighted zero, however, criterion #8 will be weighed a maximum of 25 points and criterion #11 a maximum of 25 points.

2. Federal agencies may assign relative weights among the 12 site assessment criteria other than those shown on the FPPA rule after submitting individual agency FPPA policy for review and comment to NRCS. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total points at 160. For project sites where the total points equal or exceed 160, consider alternative actions, as appropriate, that could reduce adverse impacts (e.g. Alternative Sites, Modifications or Mitigation).

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, convert the site assessment points to a base of 160.
Example: if the Site Assessment maximum is 200 points, and the alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \text{ X } 160 = 144 \text{ points for Site A}$$

For assistance in completing this form or FPPA process, contact the local NRCS Field Office or USDA Service Center.

NRCS employees, consult the FPPA Manual and/or policy for additional instructions to complete the AD-1006 form.

AECOM
10 Patewood Drive, Bldg. VI, Suite 500
Greenville, SC 29615

864.234.3000 tel
864.234.3069 fax

April 26, 2017

Mr. Steve Blanford
Natural Resources Conservation Service
771 Corporate Drive, Suite 300
Lexington, KY 40503

SUBJECT: Request for Farmland Conversion Impact Rating – Shawnee Fossil Plant Proposed New Dry Coal Combustion Residuals (CCR) Landfill Alternative Sites

Dear Mr. Blanford,

We appreciate your response to our initial request on February 16, 2017. As mentioned in our previous request, AECOM is working with the Tennessee Valley Authority (TVA) in the preparation of an Environmental Impact Statement for management of coal combustion residuals (CCR) at TVA's Shawnee Fossil Plant (SHF) near Paducah, Kentucky. The proposed project includes the closure of Ash Impoundment 2 and the existing Special Waste Landfill at SHF and either: a) the construction and operation of a new dry CCR landfill on another portion of the SHF property, or b) the transport of CCR to an existing permitted landfill.

The initial request (2/18/17) included a proposed new dry CCR landfill with a disturbance area of 238 acres (Site A on Figure 1). Upon review of various project considerations, TVA has reduced the proposed disturbance area to 203 acres (Site B on Figure 2). Additionally, based on the results of our initial request, TVA has elected to request an evaluation for prime farmlands on previously considered alternative sites (Sites C through E on Figures 3 and 4).

TVA continues to conduct investigations and prepare the NEPA compliance documentation for the proposed project. This documentation will include a comprehensive analysis of pertinent environmental impacts, including prime or unique farmlands, as well as an analysis of project alternatives. This letter is being submitted under the provisions of the Farmland Protection Policy Act (FPPA).

TVA purchased part of Site A/B/C in 2016. Prior to that time, at least some portions of the property were in agricultural land use. The site would be used to provide borrow material for the closure of Ash Impoundment 2 and the existing Special Waste Landfill, and potentially then for construction and operation of a new dry CCR landfill.

Enclosed is our revised Form AD-1006, the Farmland Conversion Impact Rating Form, with Parts I and III completed. Additional site alternatives have been added. Also included is a map showing soil types and farmland classification of the proposed project site for each project alternative (Figures 2 through 5). To ensure compliance with the FPPA and to support the NEPA process, TVA requests that the Natural Resources Conservation Service review the enclosed project-specific information and complete Parts II, IV, and V on the enclosed Form AD-1006 for Sites B through E.

TVA staff will forward to your office, through the Kentucky Clearinghouse, a copy of the draft NEPA document, when it is available for distribution, along with a request for comments.

If you have any questions regarding this proposed project, please contact me at 864-234-8913 (bobbie.hurley@aecom.com) or Ashley Pilakowski at 865-632-2256 (aapilakowski@tva.gov).

Sincerely,

Roberta A. Hurley
Project Manager

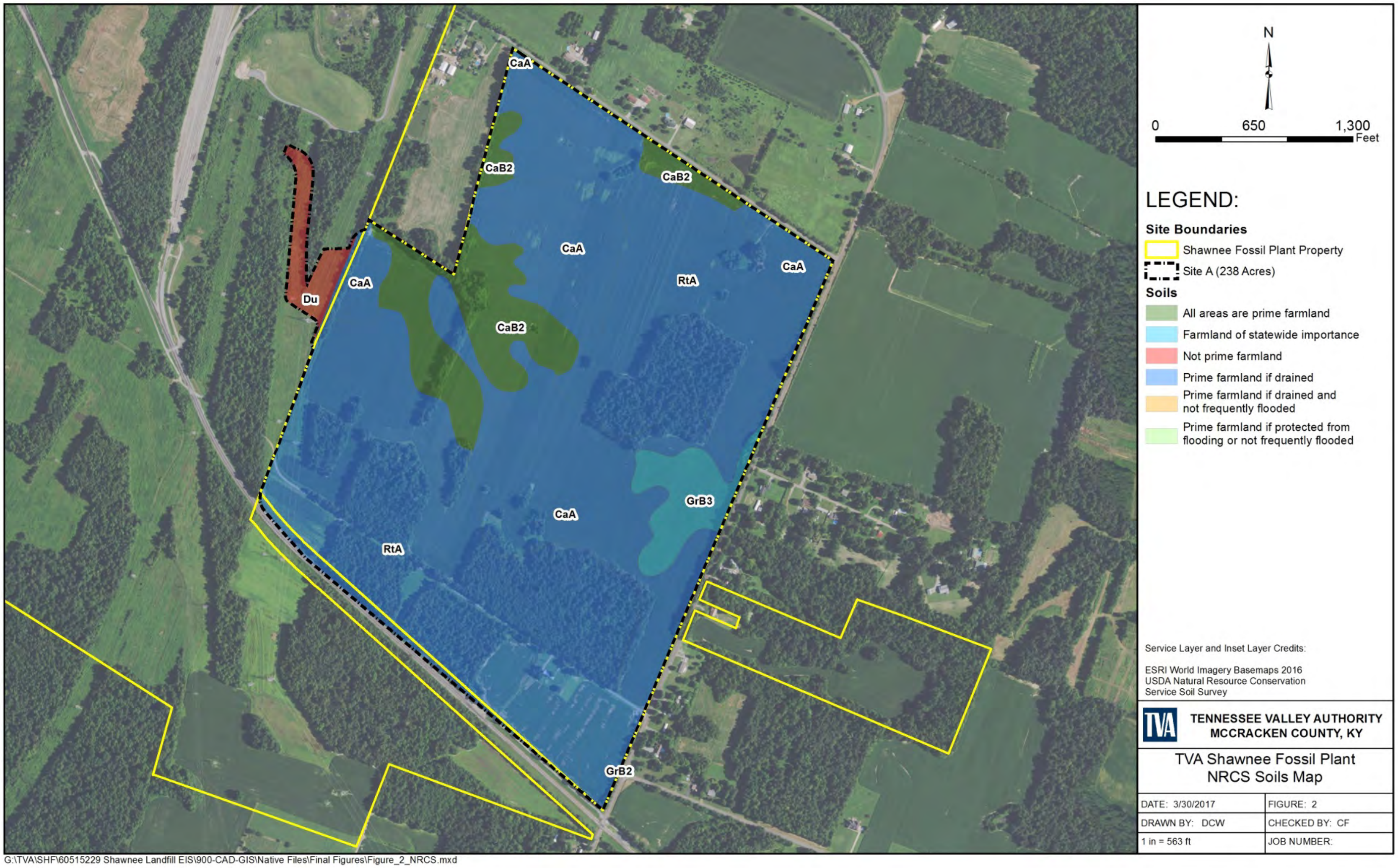


Figure 1. Site A (238 acres) from initial request (February 2017)

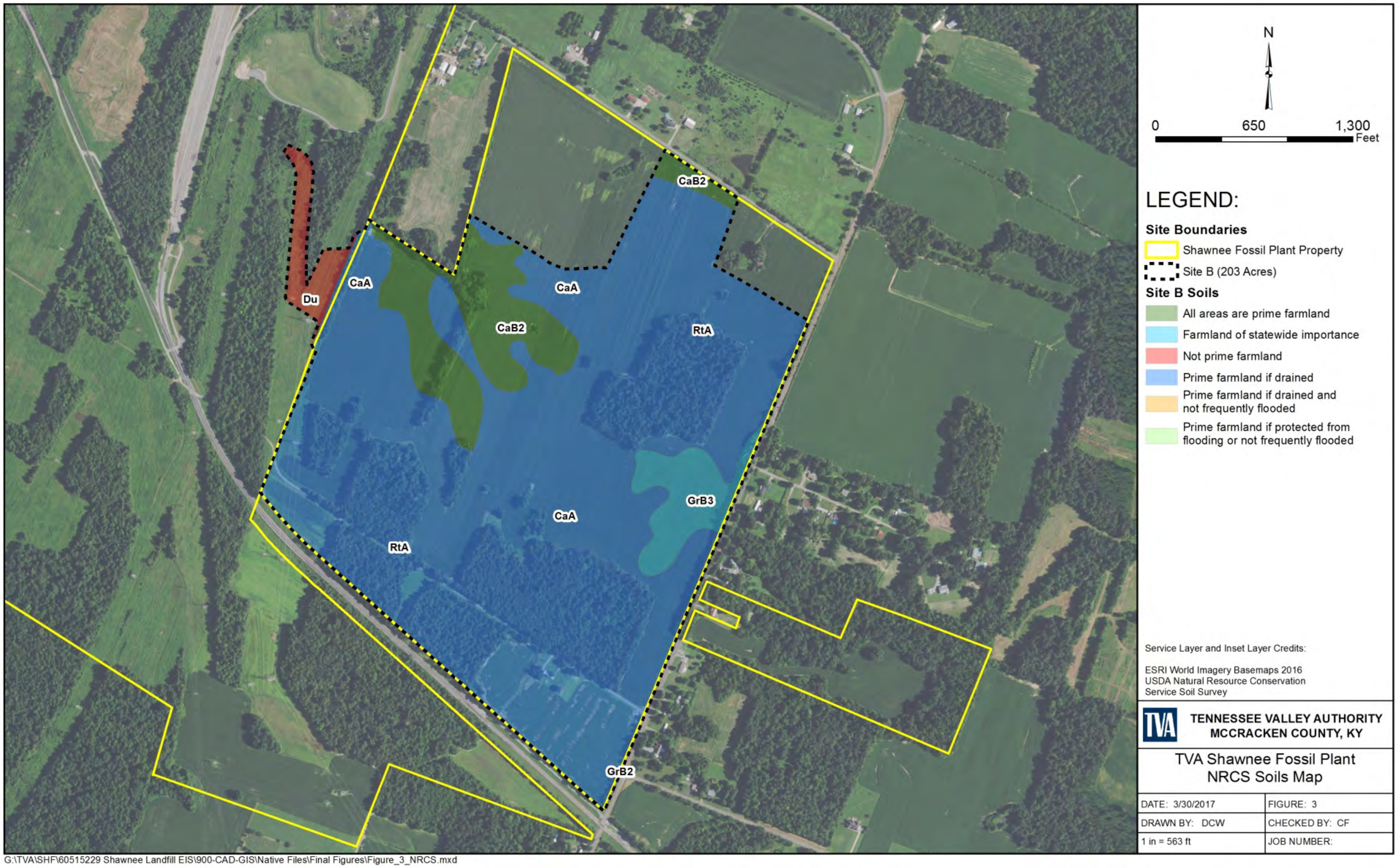
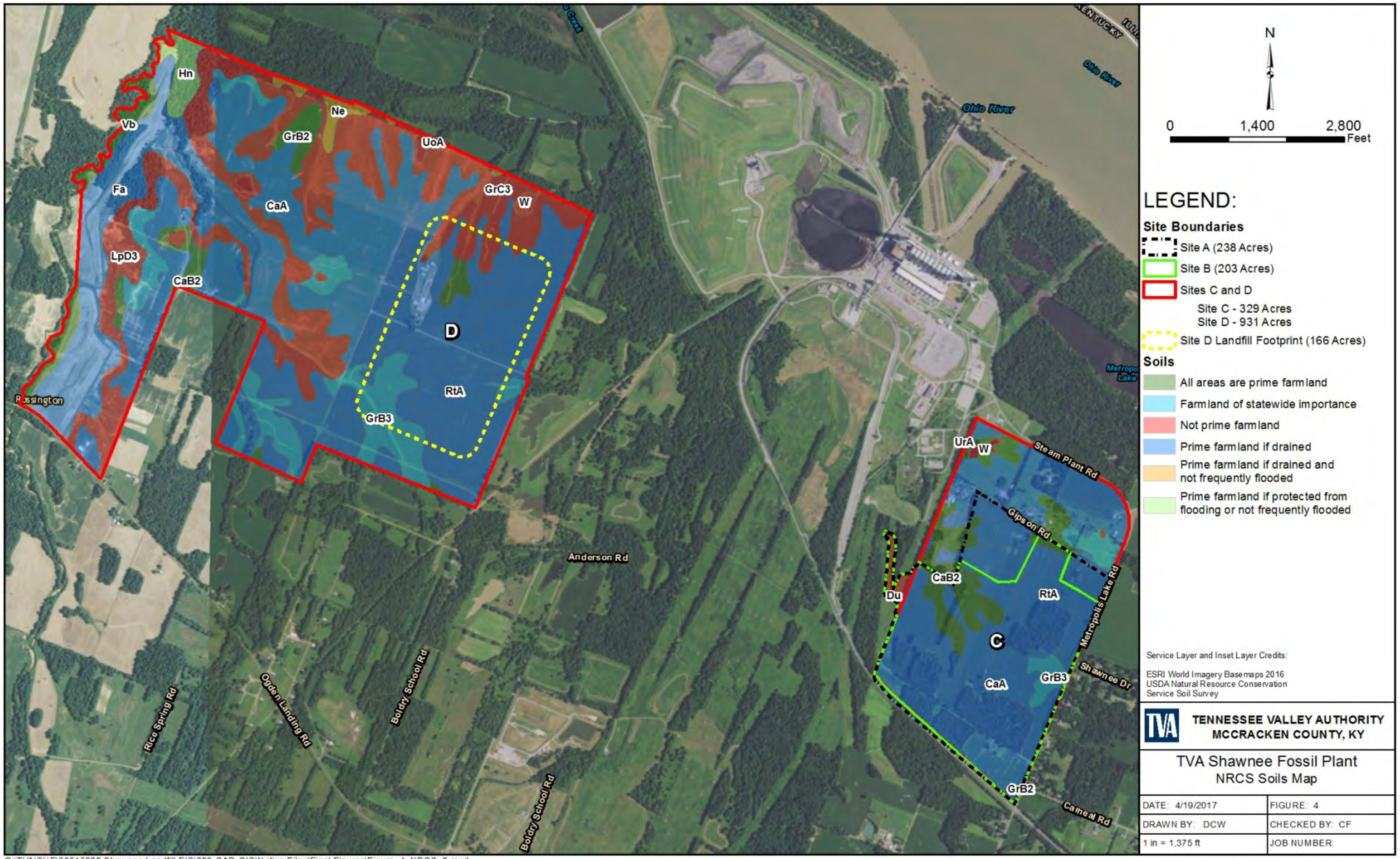


Figure 2. Site B (203 acres)



G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Final Figures\Figure_4_NRCS_2.mxd

Figure 3. Sites C (329 acres), and D (931 acres)

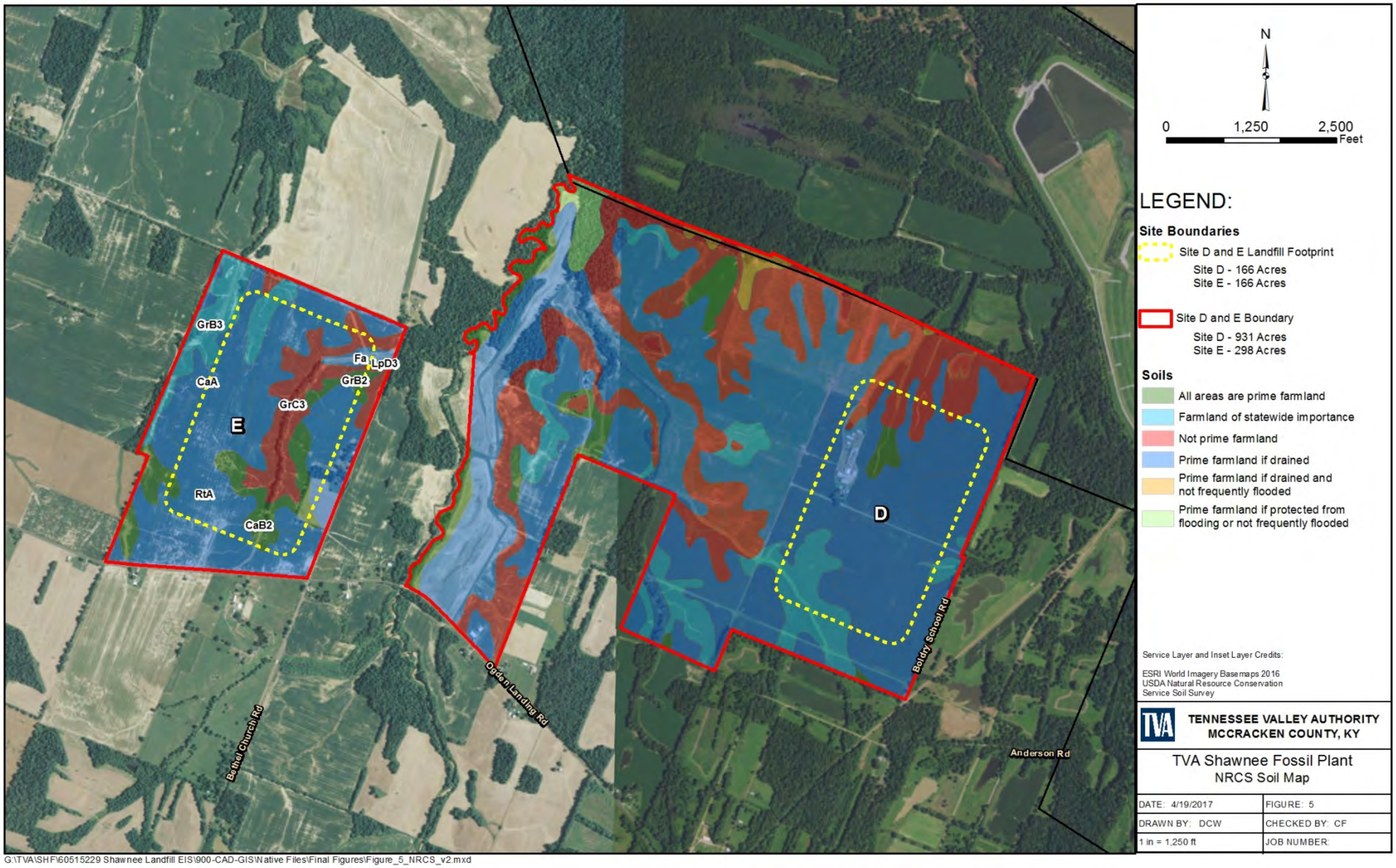


Figure 4. Sites D (931 acres) and E (298 acres)

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 04/19/2017
Name of Project SHF CCR Management EIS	Federal Agency Involved Tennessee Valley Authority
Proposed Land Use New Dry CCR Landfill	County and State McCracken County, Kentucky
PART II *(To be completed by NRCS)*	Date Request Received By NRCS / Person Completing Form:

Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☑ NO ☐	Acres Irrigated	Average Farm Size
Major Crop(s): CORN	Farmable Land In Govt. Jurisdiction — Acres: 126,05 % 90.6	Amount of Farmland As Defined in FPPA — Acres: 106,25 % 76.4	
Name of Land Evaluation System Used: LESA	Name of State or Local Site Assessment System	Date Land Evaluation Returned by NRCS	

PART III *(To be completed by Federal Agency)*		Alternative Site Rating			
		Site B	Site C	Site D	Site E
A. Total Acres To Be Converted Directly		203	337	931	298
B. Total Acres To Be Converted Indirectly		0	0	0	0
C. Total Acres In Site		203	337	931	298
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland		189.5	314.0	625.5	222.2
B. Total Acres Statewide Important or Local Important Farmland		8.5	16.2	80.1	31.9
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted		0.16	0.26	0.56	0.20
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value		62.3	62.3	82.2	70.5
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)		82	82	77	81
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site B	Site C	Site D	Site E
1. Area In Non-urban Use	(15)	15	15	15	15
2. Perimeter In Non-urban Use	(10)	10	10	10	10
3. Percent Of Site Being Farmed	(20)	15	15	18	19
4. Protection Provided By State and Local Government	(20)	0	0	0	0
5. Distance From Urban Built-up Area	(15)	13	13	15	15
6. Distance To Urban Support Services	(15)	0	0	0	0
7. Size Of Present Farm Unit Compared To Average	(10)	10	10	10	10
8. Creation Of Non-farmable Farmland	(10)	10	10	10	10
9. Availability Of Farm Support Services	(5)	4	4	4	4
10. On-Farm Investments	(20)	6	9	8	6
11. Effects Of Conversion On Farm Support Services	(10)	0	0	0	0
12. Compatibility With Existing Agricultural Use	(10)	5	5	5	5
TOTAL SITE ASSESSMENT POINTS	160	88	91	95	94
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	82	82	77	81
Total Site Assessment *(From Part VI above or local site assessment)*	160	88	91	95	94
TOTAL POINTS *(Total of above 2 lines)*	260	170	173	172	175

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐

Reason For Selection:

Name of Federal agency representative completing this form:	Date:

(See Instructions on reverse side) **Form AD-1006 (03-02)**

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 - Federal agencies (or Federally funded projects) involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form. For Corridor type projects, the Federal agency shall use form NRCS-CPA-106 in place of form AD-1006. The Land Evaluation and Site Assessment (LESA) process may also be accessed by visiting the FPPA website, http://fppa.nrcs.usda.gov/lesa/.

Step 2 - Originator (Federal Agency) will send one original copy of the form together with appropriate scaled maps indicating location(s)of project site(s), to the Natural Resources Conservation Service (NRCS) local Field Office or USDA Service Center and retain a copy for their files. (NRCS has offices in most counties in the U.S. The USDA Office Information Locator may be found at http://offices.usda.gov/scripts/ndISAPI.dll/oip_public/USA_map**,** or the offices can usually be found in the Phone Book under U.S. Government, Department of Agriculture. A list of field offices is available from the NRCS State Conservationist and State Office in each State.)

Step 3 - NRCS will, within 10 working days after receipt of the completed form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland. (When a site visit or land evaluation system design is needed, NRCS will respond within 30 working days.

Step 4 - For sites where farmland covered by the FPPA will be converted by the proposed project, NRCS will complete Parts II, IV and V of the form.

Step 5 - NRCS will return the original copy of the form to the Federal agency involved in the project, and retain a file copy for NRCS records.

Step 6 - The Federal agency involved in the proposed project will complete Parts VI and VII of the form and return the form with the final selected site to the servicing NRCS office.

Step 7 - The Federal agency providing financial or technical assistance to the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

(For Federal Agency)

Part I: When completing the "County and State" questions, list all the local governments that are responsible for local land use controls where site(s) are to be evaluated.

Part III: When completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them or other major change in the ability to use the land for agriculture.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities planned build out capacity) that will cause a direct conversion.

Part VI: Do not complete Part VI using the standard format if a State or Local site assessment is used. With local and NRCS assistance, use the local Land Evaluation and Site Assessment (LESA).

1. Assign the maximum points for each site assessment criterion as shown in § 658.5(b) of CFR. In cases of corridor-type project such as transportation, power line and flood control, criteria #5 and #6 will not apply and will, be weighted zero, however, criterion #8 will be weighed a maximum of 25 points and criterion #11 a maximum of 25 points.

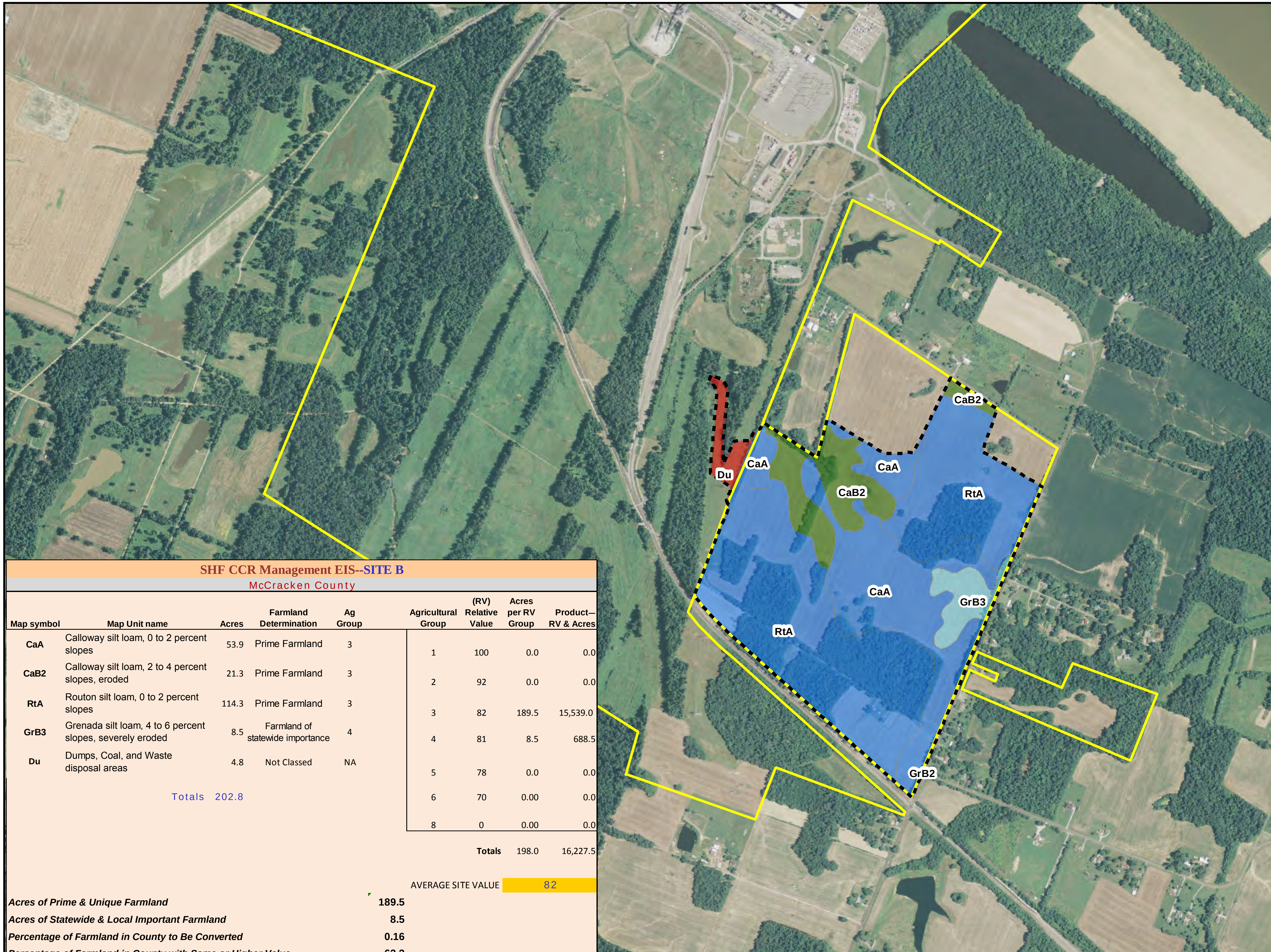
2. Federal agencies may assign relative weights among the 12 site assessment criteria other than those shown on the FPPA rule after submitting individual agency FPPA policy for review and comment to NRCS. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total points at 160. For project sites where the total points equal or exceed 160, consider alternative actions, as appropriate, that could reduce adverse impacts (e.g. Alternative Sites, Modifications or Mitigation).

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, convert the site assessment points to a base of 160.
Example: if the Site Assessment maximum is 200 points, and the alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \text{ X } 160 = 144 \text{ points for Site A}$$

For assistance in completing this form or FPPA process, contact the local NRCS Field Office or USDA Service Center.

NRCS employees, consult the FPPA Manual and/or policy for additional instructions to complete the AD-1006 form.



SHF CCR Management EIS--SITE B

McCracken County

Map symbol	Map Unit name	Acres	Farmland Determination	Ag Group
CaA	Calloway silt loam, 0 to 2 percent slopes	53.9	Prime Farmland	3
CaB2	Calloway silt loam, 2 to 4 percent slopes, eroded	21.3	Prime Farmland	3
RtA	Routon silt loam, 0 to 2 percent slopes	114.3	Prime Farmland	3
GrB3	Grenada silt loam, 4 to 6 percent slopes, severely eroded	8.5	Farmland of statewide importance	4
Du	Dumps, Coal, and Waste disposal areas	4.8	Not Classed	NA
	Totals	202.8		

Agricultural Group	(RV) Relative Value	Acres per RV Group	Product-- RV & Acres
1	100	0.0	0.0
2	92	0.0	0.0
3	82	189.5	15,539.0
4	81	8.5	688.5
5	78	0.0	0.0
6	70	0.00	0.0
8	0	0.00	0.0
	Totals	198.0	16,227.5

AVERAGE SITE VALUE 82

Acres of Prime & Unique Farmland	189.5
Acres of Statewide & Local Important Farmland	8.5
Percentage of Farmland in County to Be Converted	0.16
Percentage of Farmland in County with Same or Higher Value	62.3

\\usda.net\nrcs\Home\kymay\NRCS\jerry.mcintosh\Documents\ArcGIS\Packages\Figure_3_NRCS\v10\Figure_3_NRCS.mxd

N

0 1,000 2,000 Feet

LEGEND:

Site B (203 Acres)

Site Boundaries

Shawnee Fossil Plant Property

FARMCLAC

- All areas are prime farmland
- Farmland of statewide importance
- Not prime farmland
- Prime farmland if drained

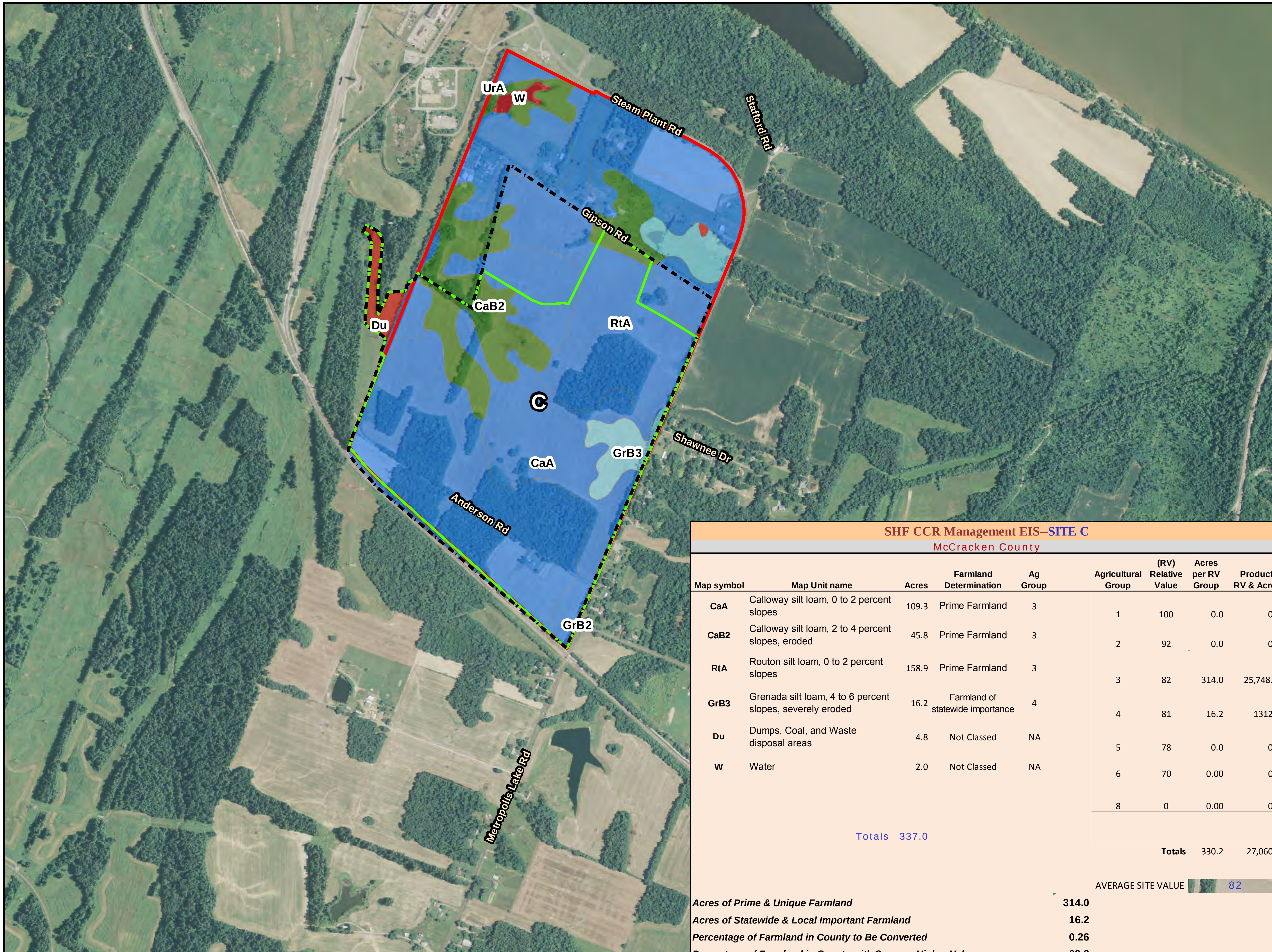
Service Layer and Inset Layer Credits:

ESRI World Imagery Basemaps 2016
USDA Natural Resource Conservation Service Soil Survey

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant NRCS Soils Map

DATE: 5/16/2017	FIGURE: 3
DRAWN BY: DCW	CHECKED BY: CF
1 in = 1,000 ft	JOB NUMBER:



N

0 1,000 2,000 Feet

LEGEND:

Site Boundaries

Site C

Soils

- All areas are prime farmland
- Prime farmland if drained
- Farmland of statewide importance
- Not prime farmland

SHF CCR Management EIS--SITE C

McCracken County

Map symbol	Map Unit name	Acres	Farmland Determination	Ag Group
CaA	Calloway silt loam, 0 to 2 percent slopes	109.3	Prime Farmland	3
CaB2	Calloway silt loam, 2 to 4 percent slopes, eroded	45.8	Prime Farmland	3
RtA	Routon silt loam, 0 to 2 percent slopes	158.9	Prime Farmland	3
GrB3	Grenada silt loam, 4 to 6 percent slopes, severely eroded	16.2	Farmland of statewide importance	4
Du	Dumps, Coal, and Waste disposal areas	4.8	Not Classed	NA
W	Water	2.0	Not Classed	NA
	Totals	337.0		

Agricultural Group	(RV) Relative Value	Acres per RV Group	Product—RV & Acres
1	100	0.0	0.0
2	92	0.0	0.0
3	82	314.0	25,748.0
4	81	16.2	1312.2
5	78	0.0	0.0
6	70	0.00	0.0
8	0	0.00	0.0
	Totals	330.2	27,060.2

AVERAGE SITE VALUE 82

Acres of Prime & Unique Farmland	**314.0**
Acres of Statewide & Local Important Farmland	**16.2**
Percentage of Farmland in County to Be Converted	**0.26**
Percentage of Farmland in County with Same or Higher Value	**62.3**

Service Layer and Inset Layer Credits:

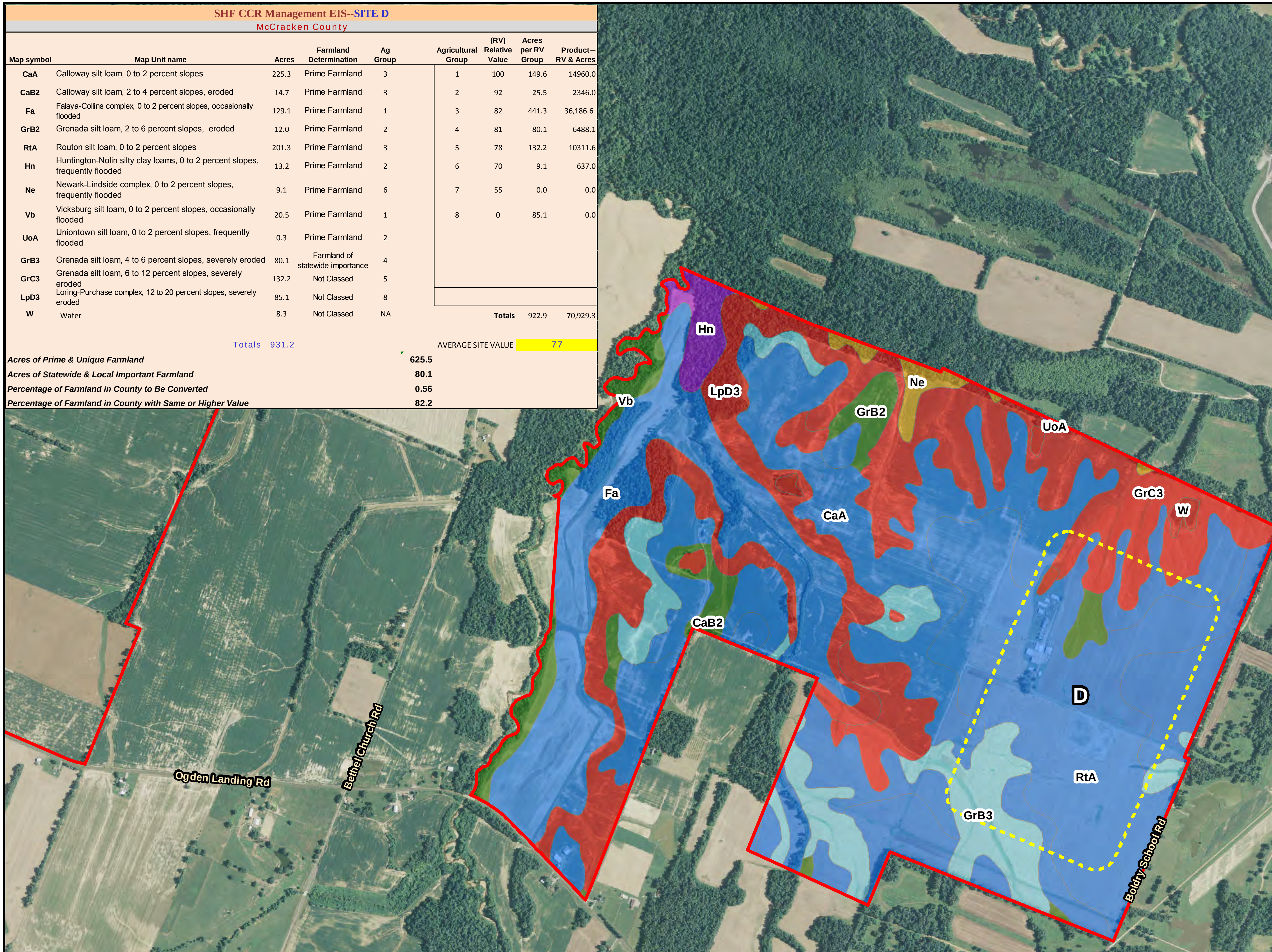
ESRI World Imagery Basemaps 2016
USDA Natural Resource Conservation Service Soil Survey

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant
NRCS Soils Map

DATE: 4/28/2017	FIGURE: 4
DRAWN BY: DCW	CHECKED BY: CF
1 in = 1,000 ft	JOB NUMBER:

\\usda.net\nrcs\Home\kymay\NRCS\jerry.mcintosh\Documents\ArcGIS\Packages\Figure_4_NRCS_2\v10\Figure_4_NRCS_2.mxd



SHF CCR Management EIS--SITE D

McCracken County

Map symbol	Map Unit name	Acres	Farmland Determination	Ag Group	Agricultural Group	(RV) Relative Value	Acres per RV Group	Product—RV & Acres
CaA	Calloway silt loam, 0 to 2 percent slopes	225.3	Prime Farmland	3	1	100	149.6	14960.0
CaB2	Calloway silt loam, 2 to 4 percent slopes, eroded	14.7	Prime Farmland	3	2	92	25.5	2346.0
Fa	Falaya-Collins complex, 0 to 2 percent slopes, occasionally flooded	129.1	Prime Farmland	1	3	82	441.3	36,186.6
GrB2	Grenada silt loam, 2 to 6 percent slopes, eroded	12.0	Prime Farmland	2	4	81	80.1	6488.1
RtA	Routon silt loam, 0 to 2 percent slopes	201.3	Prime Farmland	3	5	78	132.2	10311.6
Hn	Huntington-Nolin silty clay loams, 0 to 2 percent slopes, frequently flooded	13.2	Prime Farmland	2	6	70	9.1	637.0
Ne	Newark-Lindside complex, 0 to 2 percent slopes, frequently flooded	9.1	Prime Farmland	6	7	55	0.0	0.0
Vb	Vicksburg silt loam, 0 to 2 percent slopes, occasionally flooded	20.5	Prime Farmland	1	8	0	85.1	0.0
UoA	Uniontown silt loam, 0 to 2 percent slopes, frequently flooded	0.3	Prime Farmland	2				
GrB3	Grenada silt loam, 4 to 6 percent slopes, severely eroded	80.1	Farmland of statewide importance	4				
GrC3	Grenada silt loam, 6 to 12 percent slopes, severely eroded	132.2	Not Classed	5				
LpD3	Loring-Purchase complex, 12 to 20 percent slopes, severely eroded	85.1	Not Classed	8				
W	Water	8.3	Not Classed	NA		Totals	922.9	70,929.3
	Totals	931.2						
					AVERAGE SITE VALUE		77	

Acres of Prime & Unique Farmland	**625.5**
Acres of Statewide & Local Important Farmland	**80.1**
Percentage of Farmland in County to Be Converted	**0.56**
Percentage of Farmland in County with Same or Higher Value	**82.2**

LEGEND:

Site Boundaries

- Site D - 931 Acres
- Site D Landfill Footprint (166 Acres)

Soils

- All areas prime
- Yes if drained
- Yes if drained and not flooded
- Yes if protected from flooding
- Farmland of statewide importance
- Not prime

Service Layer and Inset Layer Credits:

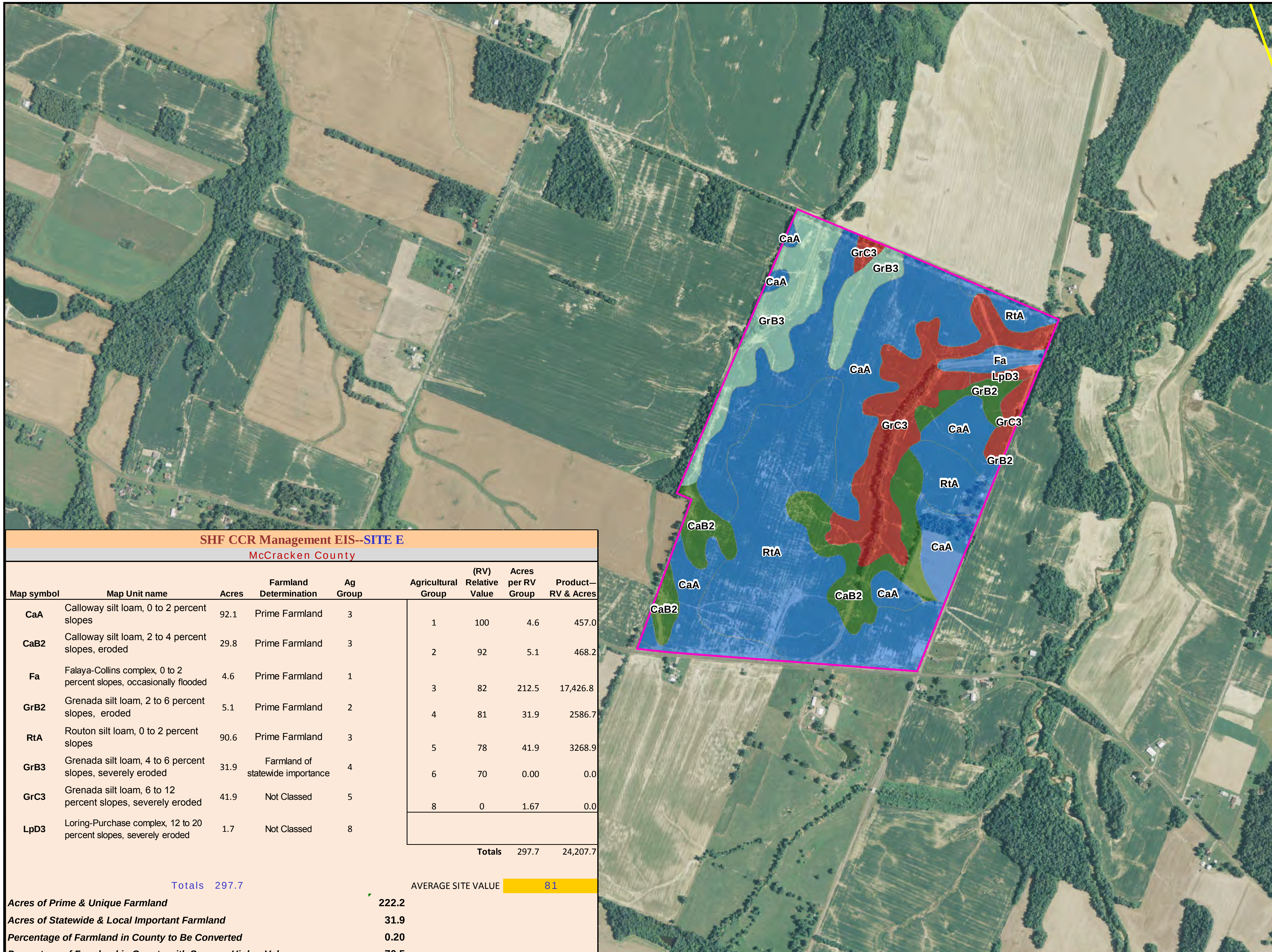
ESRI World Imagery Basemaps 2016
USDA Natural Resource Conservation Service Soil Survey

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant
NRCS Soils Map

DATE: 4/28/2017	FIGURE: 4
DRAWN BY: DCW	CHECKED BY: CF
1 in = 1,100 ft	JOB NUMBER:

\\usda.net\nrcs\Home\kymay\NRCS\jerry.mcintosh\Documents\ArcGIS\Packages\Figure_4_NRCS_2\v10\Figure_4_NRCS_2.mxd



SHF CCR Management EIS--SITE E

McCracken County

Map symbol	Map Unit name	Acres	Farmland Determination	Ag Group
CaA	Calloway silt loam, 0 to 2 percent slopes	92.1	Prime Farmland	3
CaB2	Calloway silt loam, 2 to 4 percent slopes, eroded	29.8	Prime Farmland	3
Fa	Falaya-Collins complex, 0 to 2 percent slopes, occasionally flooded	4.6	Prime Farmland	1
GrB2	Grenada silt loam, 2 to 6 percent slopes, eroded	5.1	Prime Farmland	2
RtA	Routon silt loam, 0 to 2 percent slopes	90.6	Prime Farmland	3
GrB3	Grenada silt loam, 4 to 6 percent slopes, severely eroded	31.9	Farmland of statewide importance	4
GrC3	Grenada silt loam, 6 to 12 percent slopes, severely eroded	41.9	Not Classed	5
LpD3	Loring-Purchase complex, 12 to 20 percent slopes, severely eroded	1.7	Not Classed	8
	Totals	297.7		

Agricultural Group	(RV) Relative Value	Acres per RV Group	Product--RV & Acres
1	100	4.6	457.0
2	92	5.1	468.2
3	82	212.5	17,426.8
4	81	31.9	2586.7
5	78	41.9	3268.9
6	70	0.00	0.0
8	0	1.67	0.0
	Totals	297.7	24,207.7

AVERAGE SITE VALUE 81

Acres of Prime & Unique Farmland	222.2
Acres of Statewide & Local Important Farmland	31.9
Percentage of Farmland in County to Be Converted	0.20
Percentage of Farmland in County with Same or Higher Value	70.5

\\usda.net\nrcs\Home\kymay\NRCS\jerry.mcintosh\Documents\ArcGIS\Packages\Figure_3_NRCS\v10\Figure_3_NRCS.mxd

N

0 1,000 2,000 Feet

LEGEND:

Site_E

Site Boundaries

Shawnee Fossil Plant Property

FARMCLAC

All areas are prime farmland

Farmland of statewide importance

Not prime farmland

Prime farmland if drained

Service Layer and Inset Layer Credits:

ESRI World Imagery Basemaps 2016
USDA Natural Resource Conservation Service Soil Survey

TENNESSEE VALLEY AUTHORITY
MCCRACKEN COUNTY, KY

TVA Shawnee Fossil Plant
NRCS Soils Map

DATE: 5/16/2017	FIGURE: 3
DRAWN BY: DCW	CHECKED BY: CF
1 in = 1,000 ft	JOB NUMBER:

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

July 7, 2016

Mr. Craig Potts
State Historic Preservation Officer and Executive Director
Kentucky Heritage Council
300 Washington Street
Frankfort, Kentucky 40601

Dear Mr. Potts:

TENNESSEE VALLEY AUTHORITY (TVA), SHAWNEE FOSSIL PLANT, GEOTECHNICAL STUDY FOR 200-ACRE BORROW AREA, MCCRACKEN COUNTY, KENTUCKY

TVA has recently purchased a circa 200-acre tract of land near Shawnee Fossil Plant (SHF) in McCracken County, Kentucky, and proposes to conduct a geotechnical study to assess the tract's suitability for use as a borrow area for fill material. Fill material meeting certain specifications is needed to cap coal combustion products storage areas at SHF (a 140-acre ash pond and a 200-acre dry stack). TVA would prepare a work plan for the geotechnical study, which will be based on the excavation of test pits at various locations within the tract using a backhoe (or tracked excavator). Approximately 30 test pits would be excavated to depths of 10 to 12 feet. No trees will be cut, and all potential wetland areas will be avoided. TVA has determined that the SHF 200-Acre Borrow Study Project constitutes an undertaking (as defined at 36 CFR § 800.16(y)) that has the potential to cause effects on historic properties. We are initiating consultation under Section 106 of the National Historic Preservation Act for this undertaking.

TVA has determined that the area of potential effects (APE) for archaeological resources consists of the entire circa 200-acre tract. As the proposed undertaking would result in no lasting effects on the viewshed, the undertaking has no potential to cause indirect (visual) effects to any above-ground resources that may be located within the viewshed and are included, or eligible for inclusion, in the National Register of Historic Places (NRHP). Therefore, TVA has determined that the APE for above-ground resources is the same as the APE for archaeological resources.

TVA contracted with AMEC Foster Wheeler Environment and Infrastructure, Inc. (AMEC Foster Wheeler) to perform a Phase I archaeological survey of the APE. The former landowners denied TVA permission to conduct surveys in the tract prior to the sale. Therefore, TVA performed an archaeological survey after purchasing the property. Enclosed are two copies of the draft archaeological survey report, titled *Phase I Archaeological Survey, TVA Shawnee Fossil Plant Proposed Borrow Area, McCracken County, Kentucky*, along with two CDs containing digital copies.

AMEC Foster Wheeler's background study, conducted prior to the field study, indicated that no previously recorded archaeological sites or properties listed in the NRHP are located within the survey area. The survey crew verified that the APE contains no above-ground structures. The field study included pedestrian survey and systematic shovel testing. The study identified five previously recorded historic archaeological sites (15McN189 – 15McN193), three isolated finds of archaeological material, and one non-site locale. AMEC Foster Wheeler recommends that three of the sites (15McN191, 15McN192, and 15McN193), the three isolated finds, and the non-site locale are ineligible for the NRHP. AMEC Foster Wheeler recommends that two sites (15McN189 and 15McN190) may have potential to provide significant data on nineteenth century freed slave farmsteads. The report authors recommend that TVA either avoid both sites or conduct Phase II testing in order to fully evaluate the NRHP eligibility of these two sites.

TVA has read the report and agrees with the findings and recommendations of the authors. TVA finds that there are no architectural resources in the archaeological APE. TVA finds that the APE contains two archaeological sites of undetermined NRHP eligibility: 15McN189 and 15McN190. TVA will avoid these sites. TVA will create 30-meter (98-foot) buffers around each of the two sites. The buffer will be marked on all plans to be used during physical work in the APE and will be physically marked with staking and/or reflective flagging tape. No test pits will be excavated within the site buffers. All TVA field personnel will be instructed to keep equipment outside the site buffers. Given these conditions on the work, and given that no NRHP-listed or NRHP-eligible resources were identified in the APE, TVA finds that the undertaking would result in no adverse effects on historic properties in accordance with § 800.5(b).

Pursuant to 36 CFR Part 800.5(d)(2), we are seeking your concurrence with our findings that the SHF 200-Acre Borrow project will result in no adverse effects on historic properties.

Pursuant to 36 CFR Part 800.3(f)(2), TVA is consulting with federally recognized Indian tribes regarding historic properties within the APE that may be of religious and cultural significance and are eligible for the NRHP.

If you have any questions or comments, please contact Richard Yarnell by telephone at (865) 632-3463 or by email at wryarnell@tva.gov.

Sincerely,

Clinton E. Jones
Manager, Biological and Cultural Compliance
Safety, River Management and Environment

SCC:CSD
Enclosure

PHASE I ARCHAEOLOGICAL SURVEY

TVA Shawnee Fossil Plant Proposed Borrow Area, McCracken County, Kentucky.

June 2016

INTERNAL COPIES:

Michelle Cagley, KFP 1T-KST
Kevin Davenport, LP 5E-C
Amy Henry, WT11D-K
Susan Jacks, WT11C-K
Skip Markham, BR 4A-C
Richard Yarnell, WT11D-K
EDMS, WT CA-K

MATTHEW G. BEVIN
GOVERNOR

DON PARKINSON
SECRETARY

TOURISM, ARTS AND HERITAGE CABINET
KENTUCKY HERITAGE COUNCIL
THE STATE HISTORIC PRESERVATION OFFICE

300 WASHINGTON STREET
FRANKFORT, KENTUCKY 40601
PHONE (502) 564-7005
FAX (502) 564-5820
www.heritage.ky.gov

REGINA STIVERS
DEPUTY SECRETARY

CRAIG A. POTTS
EXECUTIVE DIRECTOR
& STATE HISTORIC
PRESERVATION OFFICER

Received @ TVA
9/23/16

September 20, 2016

Mr. Clinton E. Jones
Manager, Biological and Cultural Compliance
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902

Re: Phase I Archaeological Survey: TVA Shawnee Fossil Plant Proposed Borrow Area, McCracken County, Kentucky by Marc Wampler of AMEC Foster-Wheeler

Dear Mr. Jones:

Thank you for the above referenced report. We understand that this undertaking involves several test pits to determine if fill material suitable for capping the Shawnee Fossil Plant's coal combustion products storage area is present. This project entailed pedestrian survey, geophysical survey, and screened shovel testing within the project area. The survey identified five archaeological sites (15McN189-15Mcn193), three isolated finds, and a non-site locality. The authors determined that 15Mcn191, 15McN192, 15McN193, the isolated finds, and the non-site locality are not eligible for listing in the National Register of Historic Places (NRHP). Two historic farmsteads that may provide significant data on freed slave farmsteads (15McN189 and 15McN190) were determined to be potentially eligible for the NRHP. The author recommends testing or avoidance.

The TVA agreed with the author's findings and has decided to avoid 15McN189 and 15McN190 with a 30 meter buffer around each site. As the sites are avoided the TVA finds that the undertaking would result in No Adverse Effect on Historic Properties.

I accept the above-referenced report without further revision and concur with the consultant's findings and recommendations regarding the archaeological resources. We concur with TVA's determination of No Adverse Effect to Historic Properties.

Should the project plans change, or should additional information become available regarding cultural resources or citizens' concerns regarding impacts to cultural resources, please submit that information to our office as additional consultation may be warranted. Should you have any questions, feel free to contact Nick Laracuente of my staff at 502.564.7005, extension 122.

Sincerely,

Craig A. Potts,
Executive Director and
State Historic Preservation Officer

CP:nrl KHC # 47372
cc: George Crothers (OSA)

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

June 6, 2017

Mr. Craig Potts
State Historic Preservation Officer
and Executive Director
Kentucky Heritage Council
300 Washington Street
Frankfort, Kentucky 40601

Dear Mr. Potts:

TENNESSEE VALLEY AUTHORITY (TVA), SHAWNEE FOSSIL PLANT, COAL COMBUSTION RESIDUALS (CCR) MANAGEMENT PROJECT, MCCRACKEN COUNTY, KENTUCKY

TVA proposes to construct and operate a new dry CCR landfill near Shawnee Fossil Plant (SHF) in McCracken County, Kentucky. TVA expects the existing landfill to reach capacity by the year 2027. TVA would cease operations of the current CCR landfill and Ash Pond 2 at SHF once the new CCR landfill is in operation. The new landfill would be located on a ca. 268-acre area recently purchased by TVA adjacent to, and east of, the SHF reservation. The SHF CCR Management Project includes three related actions: 1) construction and operation of the new CCR landfill; 2) closure of the existing CCR landfill; and 3) closure of Ash Pond 2. TVA has determined that the SHF CCR Management Project constitutes an undertaking (as defined at 36 CFR § 800.16(y)) that has the potential to cause effects on historic properties. We are initiating consultation under Section 106 of the National Historic Preservation Act for this undertaking.

The new CCR landfill would provide approximately 8 million cubic yards of CCR disposal capacity. The landfill would be built in four stages of 29-32 acres each; the final landfill footprint would total approximately 115 acres (Figure 1, below). The sloped sides of the landfill would be seeded with grass throughout its life, as erosion control. The landfill would be surrounded by a perimeter road and a tree buffer. There would be a stormwater runoff spillway on the west side. Adjacent facilities would include a 2-acre leachate pond, a 6-acre stormwater pond, and a 2-acre ancillary facility. An access road would connect the perimeter road to existing SHF facilities. The new landfill would take approximately 25 years to reach capacity, at which time it would have a maximum height of ca. 260 feet.

The new CCR landfill would be similar in appearance to the existing landfill (Figure 2, below). TVA contracted with Aecom for visual renderings depicting the appearance of the proposed new CCR landfill from ten points of view (enclosed).

Closure of Ash Pond 2 would involve moving coal ash from the ash pond into the existing CCR landfill. Closure of the existing CCR landfill would involve capping the landfill with a six-foot layer of homogenous clay, and seeding with grass. The closed landfill would be similar in appearance to the current landfill, which resembles a grassy hill.

In March 2016, TVA purchased ca. 200 acres of land to be used for the new CCR landfill. Initially, this land was purchased for use as a borrow source to be used in the pond closures. TVA conducted an archaeological survey on this purchased property and consulted with your office by letter dated July 06, 2016. In your response, you agreed with TVA's finding that the property contains two historic archaeological sites of undetermined eligibility for inclusion in the National Register of historic Places (NRHP): 15McN189 and 15Mc190. You also agreed with our proposal to conduct Phase II investigations at both of those sites. The Phase II investigations have been completed and we will consult further with your office in near future.

After we had completed consultation on the proposed borrow site, TVA purchased additional tracts totaling 68 acres in areas surrounding the original purchase, enlarging the project area to ca. 268 acres. In addition, TVA completed a review of three potential CCR landfill sites and selected the ca. 268-acre site as the preferred landfill location for the new landfill.

TVA has determined that the Area of Potential Effects (APE) for archaeological resources consists of the ca. 268 acres of land within which the CCR landfill would be constructed, as well as some areas within the SHF reservation where related actions are proposed. TVA has determined that the APE for above-ground resources consists of areas within a one-half mile radius of the proposed new landfill that would have unobstructed views to the completed landfill. TVA does not consider the in-place closures of Ash Pond 2 and the existing CCR landfill to have potential for effects on historic properties.

TVA contracted with Tennessee Valley Archaeological Research (TVAR) for an architectural survey of the APE for historic architectural properties. Enclosed are two copies of the draft report titled, *Phase I Architectural Survey for the Proposed TVA Shawnee Dry Ash Landfill Project, McCracken County, Kentucky*, along with two CDs containing digital copies. TVA also completed a Phase I archaeological survey of the portions of the archaeological APE not included in the first survey of the ca. 200 acres. We are consulting with your office under separate cover for the archaeological survey.

TVAR's background study, conducted prior to the field study, indicated one property listed in the National Register of Historic Places (NRHP) is located within the survey area: MCN-372 (SHF). SHF was listed on the NRHP in August 2016 under Criterion A for its historic significance as the first TVA fossil plant to be built in Kentucky. Based on the current architectural assessment, TVAR recommends that SHF continues to be eligible for the NRHP. TVAR recommends that the undertaking would result in an indirect (visual) effect on SHF, but that the effect would not be adverse because the proposed project is consistent with TVA's periodic updates to SHF as part of its regulatory obligations to abide by recent mandates issued by the Unites States Environmental Protection Agency. The APE also contains another previously recorded property, MCN-13 (ca. 1910 hipped-roof house). TVAR recommends that MCN-13 is ineligible for inclusion in the NRHP due to a lack of architectural and historic significance.

The survey resulted in the identification of 13 previously undocumented architectural resources greater than 50 years old in the APE (MCN-374 through MCN-386). These include 10 houses of various styles built between 1920 and 1965, a railroad, a box culvert, and a former service station. TVAR recommends that all 13 of these resources are ineligible for the NRHP.

TVA has read the report and agrees with the findings and recommendations of the authors. TVA finds that the APE contains one NRHP-eligible historic property, MCN-372 (SHF). TVA finds that the undertaking would result in a non-adverse effect on SHF. Although the proposed CCR landfill would visually intrude on SHF, the new landfill would be indistinguishable in appearance from the existing landfill located west of the SHF powerhouse. The existing landfill, a non-contributing element to SHF, is visible from the SHF power house and from several points within the SHF reservation. TVA finds that the addition of a second feature of a same type as an existing feature would not directly or indirectly alter any of the characteristics of SHF that qualify it as eligible for inclusion in the NRHP, and that the integrity of SHF would not be altered by the undertaking.

Pursuant to 36 CFR Part 800.5(d)(2), we are seeking your concurrence with our findings that the SHF CCR Management Project will result in no adverse effects on above-ground historic properties.

Pursuant to 36 CFR Part 800.3(f)(2), TVA is consulting with federally recognized Indian tribes regarding historic properties within the APE that may be of religious and cultural significance and are eligible for the NRHP.

If you have any questions or comments, please contact Ted Wells by telephone at (865) 632-2259 or by email at ewwells@tva.gov.

Sincerely,

Clinton E. Jones
Manager
Biological and Cultural Compliance

SCC:ABM
Enclosures

INTERNAL COPIES ONLY, NOT TO BE INCLUDED WITH OUTGOING LETTER:

James C. Adams, PSD 1A-M
A. Michelle Cagley, KFP 1T-KST
Stephen C. Cole, WT 11D-K
Kevin T. Davenport, LP 5E-C
Amy Henry, WT 11D-K
Susan R. Jacks, WT 11C-K
Ashley A. Pilakowski, WT 11D-K
M. Susan Smelley, BR 4A-C
Edward W. Wells, WT 11D-K
ECM, WT CA-K

Figure 2. Locations of existing CCR landfill and proposed new CCR landfill. Base image from Bing Birdseye views, view to southeast. Note SHF powerhouse and stacks near center of image.

ENCLOSURE. VISUAL RENDERINGS OF THE PROPOSED NEW CCR LANDFILL.

DEVELOPED FOR TVA BY AECOM

Location 1 Existing

Location 1 Build Condition Obscured by Trees (Outline Shown)

Location 2 Existing

Location 2 Build (with Perimeter Tree Buffer)

Location 3 Existing

Location 3 Build

Location 4 Existing

Location 4 Build Condition Obscured by Trees (Outline Shown)

Location 5 Existing

Location 5 Build

Location 6 Existing

Location 6 Build Condition Obscured by Trees (Outline Shown)

Location 7 Existing

Location 7 Build Condition Obscured by Trees (Outline Shown)

Location 8 Existing

Location 8 Build Condition Obscured by Trees (Outline Shown)

Location 9 Existing

Location 9 Build Condition Obscured by Trees (Outline Shown)

Location 10 Existing

Location 10 Build

Location 11 Existing

Location 11 Build

Location 11 Build (With Tree Buffer)

Location 12 Existing

Location 12 Build

Location 12 Build (With Tree Buffer)

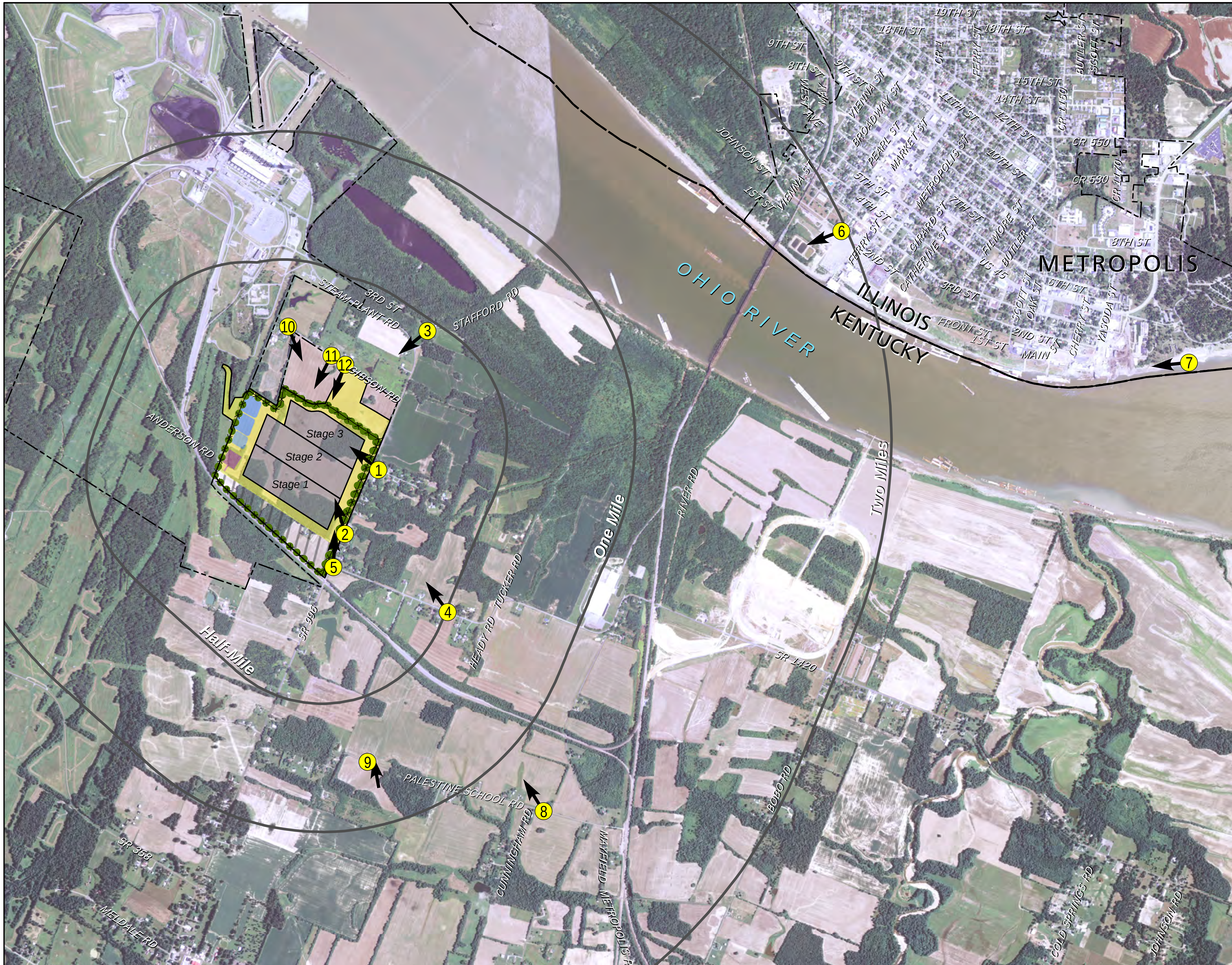


Figure XX

Photo Locations

TVA Shawnee Fossil Plant
Proposed New CCR Landfill

M:\work\TVA_Shawnee_KY\Photo_Locations_Feb17.mxd 3/9/2017 9:11:03 AM

MATTHEW G. BEVIN
GOVERNOR

DON PARKINSON
SECRETARY

TOURISM, ARTS AND HERITAGE CABINET
KENTUCKY HERITAGE COUNCIL
THE STATE HISTORIC PRESERVATION OFFICE

410 HIGH STREET
FRANKFORT, KENTUCKY 40601
PHONE (502) 564-7005
FAX (502) 564-5820
www.heritage.ky.gov

REGINA STIVERS
DEPUTY SECRETARY

CRAIG A. POTTS
EXECUTIVE DIRECTOR
& STATE HISTORIC
PRESERVATION OFFICER

August 31, 2017

Clinton E. Jones, Manager
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902

Re: ABOVEGROUND REPONSE ONLY: Phase I Architectural Survey for the Proposed TVA Shawnee Dry Ash Landfill Project McCracken County, Kentucky by Ted Karpynec and Meghan Weaver, January 2017

Dear Mr. Jones:

Thank you for your letter, plans, photos, and keyed photo locations as well as a copy of the report above for our review and comment. We apologize for our late comment on this project. We understand from your submission that the TVA proposes to construct and operate a new dry CCR landfill near Shawnee Fossil Plant in McCracken County, Kentucky. We understand that the new landfill would be located on a ca. 268-acre area recently purchased to the east of the SHF reservation. We understand that this landfill would be similar in appearance to the existing landfill (resembling a grassy hill). We understand that the author of the report has recommended that Shawnee Fossil Plant (MCN-372) preserves sufficient integrity and significance to remain Listed on the NRHP under Criterion A for its historic significance as the first TVA fossil plant built in Kentucky. We understand that MCN-13 was also identified within the APE but that it is recommended Not Eligible for listing on the NRHP. We understand that 13 previously-undocumented historic resources were identified through this survey (MCN-374 through MCN-386) and that all 13 were recommended Not Eligible for listing on the NRHP. We understand that, although the proposed landfill would be within the viewshed of Shawenee Fossil plant, the proposed project would be indistinguishable from an existing landfill to the west of Shawnee Fossil Plant and, as a result, No Adverse Effect is being recommended.

Based on our review of the report, we concur with the author's recommendations that MCN-372 should remain Listed on the NRHP and that MCN-374 through MCN-386 do not retain sufficient integrity or significance and are Not Eligible for listing on the NRHP. As such, we concur with TVA's recommendation of No Adverse Effect for the aboveground portion of this project. Please note our office has already issued its archaeology comment on this project. For our archival purposes, please submit KHC survey forms unbound from future reports. If you have any questions or if project plans should change, please contact Jennifer Ryall of my staff at 502-564-7005 ext. 4565.

Sincerely,

Craig A. Potts,
Executive Director and State Historic Preservation Officer

CP: jr, KHC#49370

MATTHEW G. BEVIN
GOVERNOR

DON PARKINSON
SECRETARY

TOURISM, ARTS AND HERITAGE CABINET
KENTUCKY HERITAGE COUNCIL
THE STATE HISTORIC PRESERVATION OFFICE
410 HIGH STREET
FRANKFORT, KENTUCKY 40601
PHONE (502) 564-7005
FAX (502) 564-5820
www.heritage.ky.gov

REGINA STIVERS
DEPUTY SECRETARY

CRAIG A. POTTS
EXECUTIVE DIRECTOR
& STATE HISTORIC
PRESERVATION OFFICER

August 31, 2017

Mr. Clinton Jones
Manager, Cultural and Biological Compliance
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902

Re: Tennessee Valley Authority, Shawnee Fossil Plant, Coal Combustion Residuals Management Project, McCracken County, Kentucky

Dear Mr. Jones:

Thank you for your letter concerning the determination of effects for the above mentioned project, received August 14, 2017. We understand the proposed project to entail the construction of a new landfill to accommodate coal combustion byproducts at the Shawnee Fossil Plant, McCracken County, Kentucky. The proposed landfill will impact a total area of potential effect of 290.67 acres.

The archaeological assessment of this APE was treated under two survey efforts. One effort, *Phase I Archaeological Survey, TVA Shawnee Fossil Plant Proposed Borrow Area, McCracken County, Kentucky* considered approximately 200 acres, and resulted in the identification of five archaeological sites, three isolated finds, and one non-site locality. Of these, two sites (15McN189 and 15McN190) were recommended for avoidance or additional Phase II National Register evaluation. The TVA proposed to avoid these sites with an additional thirty meter buffer. We concurred with the avoidance measure in a letter dated September 20, 2016. A second effort, *Phase I Archaeological Survey, TVA Shawnee Fossil Plant Additional Property Acquisitions, McCracken County, Kentucky* considered the remaining APE, and resulted in the identification of two archaeological sites and one isolated find. None of these were recommended as eligible for the National Register, and no additional work was recommended. TVA recommended that the project would result in no effect to archaeological resources in this part of the project area, and we concurred with this determination on August 4, 2017.

An architectural assessment of the APE was also undertaken, and was described in *Phase I Architectural Survey for the Proposed TVA Shawnee Dry Ash Landfill Project McCracken County, Kentucky*. The report recommended that MCN-372 should remain Listed on the National Register. Historic resources MCN-374 through MCN-386 do not retain sufficient integrity or significance and are recommended as Not Eligible for listing on the NRHP. TVA recommended that the proposed project would thus result in No Adverse Effect to National Register listed properties, and we concurred with this determination on August 31, 2017.

During a phone conversation between Chris Gunn of my staff and Ted Wells of the TVA August 31, 2017, it was agreed that this letter would go beyond the specific determination of effects for archaeological sites provided in TVA's letter , and consider architectural properties as well. It was also agreed that the TVA determined that the proposed landfill project at the Shawnee Fossil Plant would result in **No Adverse Effect** to historic properties. We **concur** with this determination.

Should the project plans change, or should additional information become available regarding cultural resources or citizens' concerns regarding impacts to cultural resources, please submit that information to our office as additional consultation may be warranted. Questions concerning archaeological resources can be directed to Chris Gunn at 502.564.7005, extension 4450 or chris.gunn@ky.gov. Questions concerning architectural resources can be directed to Jennifer Ryall at jennifer.ryall@ky.gov or 502.564.7005 extension 4565.

Sincerely,

Craig A. Potts,
Executive Director and
State Historic Preservation Officer

CP:cmg, jr KHC # 49838

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

September 21, 2017

Mr. Craig Potts
State Historic Preservation Officer
and Executive Director
Kentucky Heritage Council
300 Washington Street
Frankfort, Kentucky 40601

Dear Mr. Potts:

TENNESSEE VALLEY AUTHORITY (TVA), SHAWNEE FOSSIL PLANT, COAL COMBUSTION RESIDUALS MANAGEMENT (CCR) PROJECT, ARCHAEOLOGICAL SITES 15MCN189 AND 15MCN190, PHASE II TESTING, MCCRACKEN COUNTY, KENTUCKY
(37°8’15” N, 88°46’21” W) -- KHC# 47372

We have consulted previously with your office (letters dated July 7, 2016 and August 11, 2017) regarding the above-cited undertaking. During a Phase I Archaeological survey for a then-proposed ca. 200-acre soil borrow area (now being considered as the possible site of a CCR landfill), we identified historic archaeological sites 15McN189 and 15McN190. Our offices agreed that both sites should be considered to have undetermined eligibility for inclusion in the National Register of Historic Places (NRHP). We agreed, further, that TVA should avoid the sites or conduct Phase II testing (i.e. eligibility evaluation) of both sites in order to fully determine their eligibility for the NRHP.

TVA proceeded with the Phase II testing, based on a testing plan that archaeologists from Amec Foster Wheeler discussed with members of your staff prior to beginning the fieldwork. Enclosed are two hard copies of the Phase II testing report titled, *Phase II Archaeological Evaluation, Sites 15McN189 and 15McN190, TVA Shawnee Fossil Plant, McCracken County, Kentucky*, along with CDs containing digital copies.

The Phase II evaluation relied on a combination of archival methods and field investigation. The field investigation used a combination of remote sensing, close-interval shovel testing, test unit excavation, and feature excavation. The results confirm that these sites represent the mid- to late-nineteenth century farmsteads of two former African American slaves and their families, who were freed by their former owner, Dr. Robert Fletcher. Site 15McN189, which encompasses ca. 49 acres, is the residence and farmstead of Edward Fletcher, who owned the property beginning at some time after 1848. Site 15McN190, encompassing ca. 32 acres, is the residence and farmstead of George Fletcher. George Fletcher, his wife, and children lived at this location as early as 1860. Artifacts recovered during the Phase I survey indicate continuous habitation of both sites until the early- or mid-twentieth century.

During the Phase II investigation both sites yielded abundant historic artifacts spanning the mid-nineteenth to early-twentieth centuries. Features excavated at site 15McN189 include three post molds, a refuse pit, and a possible midden or refuse pit. Features excavated at site 15McN190 include two cellars (each associated with a different non-extant structure), a pier stone, and two post molds. Remote sensing anomalies, artifact distributions, and the features allow a partial reconstruction of activity areas and farmstead layouts. The investigation indicates that both sites have strong potential for additional deposits including artifact-rich features. The report authors suggest that more intensive investigations at both sites could yield much additional information about this poorly-documented early period of African American history in Kentucky, and that such information would help to resolve additional research questions that were not fully answered by the phase II investigation. Amec Foster Wheeler recommends that both sites are eligible for inclusion in the NRHP and should be avoided, or if avoidance is not possible, that additional excavations should be conducted.

TVA has read the report and agrees with the findings and recommendations of the authors. Based on this investigation TVA has determined that sites 15McN189 and 15McN190 are both eligible for the NRHP.

At the time of our consultation on the Phase I survey, we proposed that TVA avoid these sites by creating a 30-meter (98-foot) buffers around each, and avoiding all physical activities related to the soil borrow undertaking within the buffers. Although the current undertaking differs from the undertaking as we understood it at that time, the current undertaking still has potential to result in adverse effects on both sites. The CCR management undertaking would include excavation of soils to depths of up to 15 feet within the ca. 200-acre tract, both to supply soil borrow material and to create the foundation for the proposed CCR landfill. TVA continues to propose avoidance of the sites. TVA's design for the CCR landfill (see Figure 1, below) avoids both sites, including the 30-meter buffers. No excavation, grading, vegetation clearing, construction, or ground disturbance of any kind related to the undertaking will be allowed within the 30-meter site buffers. The vegetative buffer and fencing that will surround the adjacent CCR landfill will be installed outside the site buffers. The buffers will be marked on all layout drawings associated with the undertaking, and TVA environmental staff will be instructed on the required avoidance measures. Based on this avoidance plan, TVA finds that the undertaking, as currently planned, will result in no effects on either site.

Based on our previous consultation regarding the CCR Management Project, our offices have agreed that the undertaking would result in no effects on archaeological sites and no adverse effects on aboveground (historic architectural) properties (as summarized in our letter dated August 11, 2017 and your response letter dated August 31, 2017). Pursuant to 36 CFR Part 800.5(d)(2), we are seeking your concurrence with our determination that archaeological sites

15McN189 and 15McN190 are eligible for inclusion in the NRHP, and with our finding that the proposed undertaking would result in no effects on either site.

If you have any questions or comments, please contact Ted Wells by telephone, (865) 632-2259 or by email, ewwells@tva.gov.

Sincerely,

Clinton E. Jones
Manager
Cultural Compliance

SCC:ABM
Enclosures

INTERNAL COPIES ONLY, NOT TO BE INCLUDED WITH OUTGOING LETTER:

A. Michelle Cagley, KFP 1T-KST
Stephen C. Cole, WT 11D-K
Kevin T. Davenport, LP 5E-C
Raymon S. Harris, MPB 1M-M
Susan R. Jacks, WT 11C-K
Ashley A. Pilakowski, WT 11D-K
M. Susan Smelley, BR 4A-C
Ted Wells, WT 11D-K
ECM, WT CA-K

MATTHEW G. BEVIN
GOVERNOR

DON PARKINSON
SECRETARY

TOURISM, ARTS AND HERITAGE CABINET
KENTUCKY HERITAGE COUNCIL
THE STATE HISTORIC PRESERVATION OFFICE
410 HIGH STREET
FRANKFORT, KENTUCKY 40601
PHONE (502) 564-7005
FAX (502) 564-5820
www.heritage.ky.gov

REGINA STIVERS
DEPUTY SECRETARY

CRAIG A. POTTS
EXECUTIVE DIRECTOR
& STATE HISTORIC
PRESERVATION OFFICER

October 9, 2017

Mr. Clinton E. Jones
Manager, Cultural Compliance
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902

RE: **Phase II Archaeological Evaluation, Sites 15McN189 and 15McN190, TVA Shawnee Fossil Plant, McCracken County, Kentucky** prepared by Susan Andrews and John Hunter of AMEC Foster Wheeler Environment and Infrastructure, Inc. Report dated September 2017

Dear Mr. Jones:

Thank you for your letter and enclosed reports for the above-mentioned National Register evaluation, received September 22, 2017. The enclosed reports describe Phase II archaeological work at two sites at the TVA's Shawnee Fossil Plant, McCracken County, Kentucky. Sites 15McN189 and 15McN190 consist of the archaeological remains of 19th through 20th Century farmsteads and associated buildings. Phase II testing at both sites indicated the presence of intact subsurface features and robust artifact assemblages. Archival research indicated that these farmsteads were occupied by freed African Americans after the Civil War. Based on the results of the research, the investigators recommended that both sites are eligible for the National Register. The investigators recommended that both sites are avoided by activities associated with the proposed Coal Combustion Residuals (CCR) project. If the sites cannot be avoided, additional work would be warranted.

After review of the report, staff of the TVA agreed with the report's findings and eligibility recommendations that sites 15McN189 and 15McN190 are eligible for the National Register of Historic Places. After reviewing the report, we also agree with the report's findings and recommendations. We accept this report as final and acknowledge receipt of two archival copies.

Additionally, your letter indicated that the TVA proposes to avoid both sites during the proposed CCR project. Both sites will be buffered by a 100-foot no-work radius. No project activities will take place within this buffer. We agree that this is an appropriate avoidance measure. We previously commented on project effects in two letters (July 7, 2016 and August 11, 2017). Considering the avoidance plan presented in your current letter, we find that we still **concur** that the proposed project will result in **No Effect to Historic Properties**.

If the project design or boundaries change, this office should be consulted to determine the nature and extent of additional documentation that may be needed. In the event of the unanticipated discovery of an archaeological site or object of antiquity, the discovery should be reported to the Kentucky Heritage Council and to the Kentucky Office of State Archaeology in the Anthropology Department at the University of Kentucky in accordance with KRS 164.730. In the event that human remains are encountered during project activities, all work should be immediately stopped in the area and the area cordoned off, and in accordance with KRS 72.020 the county coroner and local law enforcement must be contacted immediately. Upon confirmation that the human remains are not of forensic interest, the unanticipated discovery must be reported to the Kentucky Heritage Council.

Should you have any questions concerning the project please contact Chris Gunn of my staff at 502.564.7005, extension 4450 or chris.gunn@ky.gov.

Sincerely,

Craig A. Potts,
Executive Director and
State Historic Preservation Officer

CP: cmg KHC # 50021
cc: George Crothers (OSA); Susan Andrews (AMEC)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
330 West Broadway, Suite 265
Frankfort, Kentucky 40601
(502) 695-0468

May 30, 2017

Mr. John T. Baxter, Jr.
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902

Re: FWS 2017-B-0057; Tennessee Valley Authority; Shawnee Coal Combustion Residuals Project; McCracken County, Kentucky

Dear Mr. Baxter:

The U.S. Fish and Wildlife Service (Service) has reviewed recent correspondence regarding this proposed project. Tennessee Valley Authority (TVA) proposes to close the existing Ash Pond 2 at Shawnee Fossil Plant. The Service offers the following comments in accordance with the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*).

Indiana Bat (*Myotis sodalis*)
Your March 24, 2017 correspondence indicates that there is no potential winter habitat for this species in the proposed project area. The project area does contain suitable summer roosting habitat. We have received a copy of a May 19, 2017 receipt acknowledging the $343,710.00 contribution TVA made to Kentucky Natural Lands Trust for the Imperiled Bat Conservation Fund. Your project adheres to the conservation measures associated with the Kentucky Field Office's 2016 *Revised Conservation Strategy for Forest-Dwelling Bats* (Conservation Strategy) and the 2015 Biological Opinion: *Kentucky Field Office's Participation in Conservation Memoranda of Agreement for the Indiana Bat and/or Northern Long-eared Bat* (KFO BO). The contribution made is the appropriate amount, following the process in the Conservation Strategy, to mitigate for the removal of the "summer 1" Indiana bat habitat for this project as described in your March 24, 2017 correspondence and attachments. Specifically, 68.4 acres of forested habitat removal will occur from August 16 – March 31. Through the adherence to the Conservation Strategy, the Service has already analyzed the effects of the action under the KFO BO and has concluded that the project is not likely to jeopardize the continued existence of the Indiana bat or result in the destruction or adverse modification of designated critical habitat for this species. Any incidental take of Indiana bats and/or northern long-eared bats that will or could result from the forest habitat removal associated with this project is authorized under the KFO BO. If tree clearing must occur during the occupied timeframe (April 1 – August 15), then TVA should notify the Service in advance of tree clearing to account for the direct adverse effects to Indiana bats and/or northern long-eared bats that may occur as a result of tree clearing during the occupied timeframe. In addition, if additional forested areas not previously considered are to be removed, then TVA should coordinate with the Service to determine if additional compensation is necessary to be in ESA compliance.

Northern Long-eared Bat (*Myotis septentrionalis*)
The proposed action is consistent with the northern long-eared bat final 4(d) rule and the Service's January 5, 2016, intra-Service Programmatic Biological Opinion (4(d) BO) on the final 4(d) rule for the northern long-eared bat. The project does not (1) propose impacts to any known northern long-eared bat hibernacula; (2) propose tree clearing within 0.25-mile of a known northern long-eared bat hibernacula; or, (3) propose cutting or destroying known occupied maternity roost trees, or any other trees within a 150-foot radius from the maternity roost tree from June 1 through July 31. This project may affect the northern long-eared bat; however, there are no effects beyond those previously disclosed in the Service's 4(d) BO. Any taking that may occur incidental to this project is not prohibited under the final 4(d) rule (50 CFR §17.40(o)).

Gray Bat (*Myotis grisescens*)
Your March 24, 2017 correspondence indicates that there are no potential gray bat hibernacula or roosting habitat in the proposed project area. A few small wetlands in the project area do provide potential foraging and commuting habitat for the gray bat. Because of the small scale of the permanent impacts, we believe that any impacts to gray bat foraging habitat and resources would be insignificant and/or discountable. Based on this information, the Service concurs that the proposed project is not likely to adversely affect the gray bat.

In addition to the species discussed above, you also determined that the proposed project would have "no effect" on the following species: interior least tern (*Sterna antillarum athalassos*), clubshell (*Pleurobema clava*), fanshell (*Cyprogenia stegaria*), fat pocketbook (*Potamilus capax*), orangefoot pimpleback (*Plethobascus cooperianus*), pink mucket (*Lampsilis abrupta*), rabbitsfoot (*Quadrula c. cylindrica*), ring pink (*Obovaria retusa*), rough pigtoe (*Pleurobema plenum*), sheepnose (*Plethobasus cyphyus*), and spectaclecase (*Cumberlandia monodonta*). The Service has no further comments regarding these species.

In view of these findings we believe that the requirements of section 7 of the Endangered Species Act have been fulfilled for this project. Your obligations under section 7 must be reconsidered, however, if: (1) new information reveals that the proposed action may affect listed species in a manner or to an extent not previously considered, (2) the proposed action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated.

Thank you again for your request. Your concern for the protection of endangered and threatened species is greatly appreciated. If you have any questions regarding the information that we have provided, please contact Jessica Blackwood Miller at (502) 695-0468 extension 104 or jessica_miller@fws.gov.

Sincerely,

Jennifer Garland

for Virgil Lee Andrews, Jr.
Field Supervisor

Appendix G – Landfill Siting Study

Project Planning Document (Rev. 0)

New Landfill Siting Study
TVA Project No. FP609511
Shawnee Fossil Plant
Paducah, McCracken County, Kentucky

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

July 28, 2015

Stantec Consulting Services Inc.
Design with community in mind
www.stantec.com

Stantec Consulting Services Inc.
601 Grassmere Park Road, Suite 22, Nashville, Tennessee 37211

July 28, 2015

rpt_001_172675016_Rev.0

Attention: Mr. Shane Harris
Tennessee Valley Authority
1101 Market Street, LP-5G
Chattanooga, Tennessee 37402-2801

Reference: Project Planning Document (Rev. 0)
Coal Combustion Residual Landfill Siting Study
TVA Project No. FP609511
Shawnee Fossil Plant
Paducah, McCracken County, Kentucky

Dear Mr. Harris:

Stantec Consulting Services Inc. (Stantec) is pleased to submit this Project Planning Document (PPD) for the New Landfill Siting Study at the Shawnee Fossil Plant near Paducah, Kentucky. This document presents the results of the planning, conceptual design, and JPT decisions made throughout the project.

Stantec appreciates the opportunity to provide engineering services for this project. If you have any questions, please contact our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Richard Schuff

Richard G. Schuff, P.E.
Principal
rick.schuff@stantec.com

Ashley T. Smith

Ashley T. Smith, P.E.
Project Manager
ashley.smith@stantec.com

Project Planning Document (Rev. 0)

New Landfill Siting Study
TVA Project No. FP609511
Shawnee Fossil Plant
Paducah, McCracken County, Kentucky

Table of Contents

Section **Page No.**

Table of Contents
(Continued)

List of Tables

List of Attachments

Project Planning Document (PPD)

New Landfill Siting Study

Shawnee Fossil Plant

Revision 0

Project Planning Document
New Landfill Siting Study
TVA Project ID FP609511

SHAWNEE FOSSIL PLANT
Capital Project ID: FP609511
New Landfill Siting Study
PROJECT PLANNING DOCUMENT
REVISION 0

Approvals	**Signature**	**Date**
SHF Plant Manager:	______________________	__________
P&CC Project Manager:	______________________	__________
P&CC Engineering Program Manager:	______________________	__________
P&CC Construction Manager:	______________________	__________
P&CC Environmental Support:	______________________	__________
RHO&M Field Supervisor:	______________________	__________
P&CC Projects General Manager:	______________________	__________
P&CC Engineering General Manager:	______________________	__________
P&CC Construction General Manager:	______________________	__________

Project Planning Document
New Landfill Siting Study
TVA Project ID FP609511

PPD RECORD OF REVISION

REVISION DATE	DESCRIPTION OF REVISION
July 9, 2015	Rev. A - PPD
July 28, 2015	Rev. 0 - PPD

Project Planning Document
New Landfill Siting Study
TVA Project ID FP609511

Joint Project Team Listing

Last Name	First Name	Representing Organization or Role	Phone Number	Email Address
Harris	Shane	TVA – Sr. Program Manager	[redacted]	rsharri0@tva.gov
Hayward*	Megan	TVA – Project Manager	[redacted]	mhayward@tva.gov
Godfrey	Gary	TVA – Realty Services	[redacted]	gagodfrey@tva.gov
Hatton	Brad	TVA – Methods and Process Manager	[redacted]	bwhatton@tva.gov
Hooper	Ronda	TVA – Solid Waste Specialist	[redacted]	rlhoope0@tva.gov
Horton	Jacob	TVA – RHOM Field Supervisor	[redacted]	mjhorton@tva.gov
Jones	Greg	TVA – RHOM Construction Manager	[redacted]	gjones4@tva.gov
Lawrence	Holly	TVA – SHF Environmental Scientist	[redacted]	hjlawrence@tva.gov
Love	Brad	TVA – Water Specialist	[redacted]	bmlove@tva.gov
Phillips	Matthew	TVA – SHF Environmental Scientist	[redacted]	maphillips0@tva.gov
Robinson	David	TVA – Project Environmental Support	[redacted]	dwrobins@tva.gov
Thompson	Traci	TVA – SHF Systems Engineer	[redacted]	tethompson@tva.gov
Wilford	Gary	TVA – Project Construction Manager	[redacted]	gwilford@tva.gov
Bader	Nathan	Stantec	[redacted]	nathan.bader@stantec.com
Field	Steve	Stantec	[redacted]	steven.field@stantec.com
Schuff**	Rick	Stantec	[redacted]	rick.schuff@stantec.com

* Project Manager
** Responsible Engineer (RE)

Project Planning Document (Rev. 0)

New Landfill Siting Study
TVA Project No. FP609511
Shawnee Fossil Plant
Paducah, McCracken County, Kentucky

1. Problem/Issue/Project Description

The Tennessee Valley Authority's (TVA) Shawnee Fossil Plant (SHF) is located in McCracken County, Kentucky. The plant is located on the south bank of the Ohio River, about 13 miles northwest of Paducah, Kentucky. TVA has plans to install selective catalytic reduction (SCR) and flue gas desulfurization (FGD) systems at two of the seven units at the SHF by December 31, 2017. As a result, TVA will need a new landfill facility to meet increased storage capacity requirements for the coal combustion residuals (CCRs) to be generated by the FGD system. The purpose of this project is to build a new special waste landfill to serve the Shawnee Fossil Plant, and store CCRs produced during operation at the FGD system at this facility after the new landfill becomes operational.

A Landfill Siting Study Report was completed by Stantec and included in Attachment A. The study identified and evaluated six possible landfill properties. This Project Planning Document (PPD) also includes a conceptual level design and construction cost opinion, risk matrix & operating costs.

2. Project Goals and Objectives

The objective of this project is to identify a location for a new special waste landfill to serve SHF, and store coal combustion residuals (CCRs) produced there. Providing a 20-year storage capacity for fly ash, bottom ash, FGD, and other wastes produced at SHF is the project design goal. The overall project schedule is targeted to have a new landfill sited, designed, permitted, constructed and ready to receive dry-handled CCRs as soon as possible after the SCR/FGD project goes on line on December 31, 2017. The required site size was calculated from the information shown in Table 2.1.

Table 2.1. Waste Generation

	2020-2025		2026-2040		Total 2020-2040	
CCR STREAM[1]	LOWER EST[2]	UPPER EST[2]	LOWER EST	UPPER EST	LOWER EST	UPPER EST
BOTTOM ASH (tpy)	28,600	28,600	28,600	28,600		
FLY ASH (tpy)	247,000	247,000	247,000	247,000		
FGD (tpy)[3]	82,000	219,000	369,000	985,500		
TOTAL (tpy)	357,600	494,600	644,600	1,261,100		
TOTAL DURING PERIOD (tons)	2,145,600	2,967,600	9,024,400	17,644,400	11,170,000	20,623,000
TOTAL DURING PERIOD (cy)	1,990,000	2,750,000	8,355,900	16,347,600	10,342,600	19,095,400

[1]Data from Shawnee Fossil Plant Units 1 & 4 – Final Environmental Assessment
[2]Lower and Upper Estimates based on sources of coal used; lower estimate based on continued use of current coal sources
[3]FGD CCR from units 1&4 (2020-2025) and from all nine units from 2026-2040

The best potential alternative site is selected in Phase I. The landfill would be located and designed in accordance with the Kentucky Division of Waste Management (KDWM) solid waste rules for a Special Waste Class II Disposal Facility and the Environmental Protection Agency's final rule for Disposal of Coal Combustion Residuals from Electric Utilities.

3. Candidate Sites Considered

The Siting Study included the identification of potential sites and analysis of their feasibility. Six candidate sites were initially considered and presented at Workshop 1. These potential sites ranged in size from approximately 298 acres to 935 acres and also included three third-party permitted disposal sites. The Joint Project Team (JPT) decided which potential sites of those initially identified should receive further consideration. The selected remaining candidate sites were subjected to criteria and scored accordingly.

In Workshop 2 the Joint Project Team (JPT) selected Option 1 (see Attachment G) as the best potential site for which a Conceptual Design and this Project Planning Document (PPD) were then prepared. For detailed information about the methodology in selecting the best potential site, see Attachment A. Option 1 consists of approximately 328 acres and is located east and adjacent to the existing Shawnee Fossil Plant. The site is bisected by two public roads (Anderson Road and Gipson Road), which will need to be abandoned. The site also contains a stream and wetlands, but no floodplain.

3.1. Recommended Candidate Landfill Design

The concept design solution includes operations and access roadways, sediment ponds, leachate collection and storage, and liner/cap designs. This document includes the opinions of probable costs (Attachment B) and risk analysis (Attachment D) of the selected option. Specific aspects of the transport of CCRs from the plant to the landfill site will be handled under a separate project.

3.2. Site Constraints

The landfill site was influenced by various site constraints and existing infrastructure. These constraints were primarily identified as a result of the Siting Study and are summarized below. The constraints that affect the property and the corresponding buffers are shown on the New Landfill Conceptual Drawings in Attachment F. Further field confirmation of the extent of these constraints will be accomplished during Phase 2.

3.2.1. Streams

No field delineations of potential streams on the site have been performed. The United States Geological Survey (USGS) mapping of the Joppa Quadrangle (2012) was used as a basis for establishing minimum stream impacts. A desktop survey based on aerial photographs and contour information was used to further identify potential streams in the project area. The streams identified in the desktop survey were used to estimate the length and cost of mitigating the stream impacts.

3.2.2. Wetlands

Potential jurisdictional wetlands have been identified from public domain from the Commonwealth of Kentucky.

3.2.3. Floodplain

The Federal Emergency Management Agency (FEMA) has defined a base flood zone in the project area. This zone has a 1% chance of flood inundation in any given year. It is also referred to as the 100-year flood zone. The floodplain elevation is approximately El. 336.5. All of the selected site is above the floodplain elevation.

3.2.4. Gaseous Diffusion Plant

Option 1 is within the known area of contamination from the United States Department of Energy's Gaseous Diffusion Plant (GDP). This may create the need for some special handling of drill cuttings and groundwater samples.

3.2.5. Regulatory Setbacks

KDWM requires that Special Waste landfills be located, designed, constructed, operated and maintained such that the fill areas are at minimum:

1. 100 feet from all property lines.
2. 250 feet from wells.
3. 250 feet from normal boundaries of springs, streams, lakes.

3.2.6. County Roads – Anderson Road and Gipson Road

Option 1 is bisected by two public county roads, Anderson Road and Gipson Road. The public rights-of-way of both roads will need to be abandoned as part of this project.

3.3. Landfill Footprint

One landfill footprint was evaluated as part of this study. This footprint was situated spatially, to satisfy required buffers (after mitigation), and geographically, to maximize storage volume. The footprint evaluated was 140 acres and the average conceptual volume achieved was approximately 21,000,000 cubic yards. The precise location of this footprint may be adjusted after completion of Phase 2 investigations.

4. Scope of Recommended Design Solution

Meetings were held on April 16, 2015, May 21, 2015, and June 11, 2015, with the Joint Project Team (JPT) to review and discuss the approach to the project and the alternatives. Key factors in selecting the recommended site for the landfill include availability, location, regulatory considerations, anticipated opposition, & economics. Minutes from the review meetings are included in Attachment C.

4.1. Recommended Landfill Solution

The JPT selected the Option 1 site based on the overall scoring and ranking, as described in the Siting Study in Attachment A. Based on a conceptual understanding of these design solutions, the scope of work for Option 1 landfill will include the following items:

1. Phase 1 – Initial Landfill Site Evaluation (Summer 2015)
   - Perform initial screening of potential landfill properties (complete)
   - Purchase property for future landfill
   - Select Final Landfill Site (complete)
   - Submit Landfill Siting Study Report (complete)
2. Phase 2 – Landfill Engineering and Permitting
   - Prepare Environmental Permitting (SWPPP, KPDES, 401/404, Title V Air Permit)
   - Complete Hydrogeologic/Geotechnical Exploration
   - Complete Hydrogeologic Report and Permit Design & Operations Narrative and Drawings
   - Submit Kentucky Division of Waste Management (KDWM), Division of Solid Waste Management (DSWM) Special Waste Facility Permit Application
   - Develop Construction Engineering Plans for Stage 1 Development
   - Select Contractor for Stage 1 Construction
3. Phase 3 – Landfill Cell Construction
   - Construction of All Stages
   - Construction Certification Report Preparation and Submittal
   - CCR Disposal Into Stages

5. Assumptions/Limitations/Risks/Critical Success Factors

The recommended design solution has been developed around certain assumptions, limitations, and identified risks. The following unverified assumptions/ limitations and risks are recognized for the project:

5.1. Assumptions/Limitations

- Option 1 has been selected as the best potential site for a new on-site CCR landfill.
- All of the 14 properties within Option 1 will be purchased by TVA.
- All final fill slopes shown are 4H:1V. This is effectively an overall slope of a 5H:1V slope when considering the 40' benches at 40 vertical feet intervals. Final slope configurations will be developed during Phase 2.
- It is assumed that the leachate generated by the landfill will be sent to the wastewater treatment plant or a pond, and any required KPDES permit modifications will not prevent the development of the landfill.
- The two roads that are within the boundaries of Option 1 (Anderson Road and Gipson Road) can be abandoned.
- The landfill's electricity requirements can be met using plant power or local power along Steam Plant Road or Metropolis Lake Road. Potable water is assumed to come from either the plant or a main on Metropolis Road.
- Required environmental mitigation will be addressed (estimated costs have been included).
- All required permits (401/404, KDWM Special Waste Permit, Title V air permit, plant-specific dig permits, etc.) will be obtained for the project and will be completed between 5 and 7 years from submittal.
- Timely review of project documentation by TVA and Stantec.
- Environmental concerns and permit obligations will be addressed by TVA.

5.2. Risks

A risk matrix for this project has been prepared and is provided in Attachment D.

5.3. Critical Success Factors

The following are considered potentially critical to the success of the project. If not dealt with appropriately, the project goals and objectives may not be accomplished.

- Successful negotiations with KDWM resulting in approval of the proposed permit.
- Though the site is identified in McCracken County's long term land use plan to be industrial, it is currently zoned agricultural. However, TVA does not have to ask for re-zoning approvals, so the landfill will be able to be built on this property.
- If the required environmental permits cannot be obtained, the landfill will not be constructed.
- The proposed landfill will meet the applicable design standards and long-term factor of safety in accordance with KDWM and the CCR rule.

- If the contractor and/or his subcontractors fail to follow the plans and specifications, the quality of work could be compromised and/or the project completion date delayed.

- If the contractor and/or his subcontractors fail to report field conditions which are significantly different from the plans the constructability/implementability of the project could be compromised and/or the project delayed.

- If construction work is scheduled during wet weather seasons or when trying to use moisture-sensitive soil materials, project delays could be experienced.

The following measures, when implemented, will help to mitigate the previously mentioned actions and could be critical to the successful completion of the project.

- Initial dialog between the permitting agencies and TVA during the planning process to aid in expediting the permitting process.

- Initial dialog with McCracken County officials to determine land use plan changes are made in a timely manner.

- Perform thorough site surveys, hydrogeologic investigations, and engineering design evaluations to ensure the proposed landfill meets applicable design standards.

- Perform timely environmental site assessments and submission of permit applications. Interact frequently with regulators to expedite the permitting process.

- Pre-construction meeting and briefing with the contractor to identify and list efforts planned to implement the design.

- Comprehensive observation and engineering oversight of the construction and adherence to the quality control processes.

- Include allowance for project delays or “shut downs” in the project construction schedule for wet/inclement weather seasons.

- Obtain survey record drawings of constructed landfill.

- Open communication between all JPT members.

6. Environmental/Operational Impacts

Environmental/permitting needs that have been identified with respect to the project are as follows:

- **KDWM Solid Waste Permit** – All landfill facilities permitted in Kentucky will be under the jurisdiction of the Kentucky – Division of Waste Management (KDWM). Based on Stantec’s experience with similar facilities, the proposed gypsum waste stream will be classified as special waste and will be regulated by Title 401 of the Kentucky Administrative Regulations, Chapter 45 (401 KAR 45). Siting criteria for selecting the location of a special waste landfill are identified in 401 KAR 45:130. In addition, 401 KAR 45:110 lists design requirements for special waste landfills that need be taken into account when evaluating potential landfill sites. Specifically, 401 KAR 45:110, Section 1 states that the design shall comply with 401 KAR 30:031 (Environmental Performance Standards). Copies of these regulations can be found at http://www.lrc.state.ky.us/kar/TITLE401.HTM

- **KPDES Permit Modification** – Leachate generated from the facility is assumed to be sent to the wastewater treatment plant. Alternatively, it could be pumped to the existing ash pond and discharged through the site's existing KPDES outfall. The least preferred approach is to haul the leachate to an offsite treatment facility.

- **Notice of Intent (NOI) and Stormwater Pollution Prevention Plan (SWPPP) for the Construction Permit** – Because the land for this site is contiguous with the existing plant site, which already has a KPDES permit, a stormwater Notice of Intent (NOI) through KDOW to discharge runoff associated with construction activities will not be required. A project-specific SWPPP must be developed. This plan must be incorporated into the existing site Best Management Practices Plan, which is implemented in accordance with the existing KPDES permit.

- **NEPA Documentation** – This project will require the preparation of an environmental assessment. The environmental assessment has not been completed at this time.

- **401/404 Permits** – The landfill will impact various streams in the project area. The streams will be further assessed and mitigated in the environmental assessment.

- **Title V Air Permit Modification –** The facility's Title V air permit may need to be modified to include the landfill footprint and other landfill appurtenances. Fugitive dust emissions during construction and operations will need to be addressed. Routes used for construction access will be watered as needed to limit fugitive dust.

The following operational impacts have been noted and will be addressed:

- Maintenance of Traffic During Construction – A maintenance of traffic plan for construction will be prepared by the Contractor and reviewed by TVA and implemented by the Contractor during construction. This will be necessary to maintain traffic flow for maintenance and day-to-day plant operations.

- Fugitive Emissions (dust from construction, operations, and/or storage) – Construction access routes and/or storage stacks will be watered as needed to limit fugitive dust. Haul roads will likely be paved and will be swept and cleaned as needed.

- Fuel/Oil/Lube – Proper spill prevention measures will be employed by the Contractor to reduce the exposure of such events.

- Surface Water and Erosion Control – Best Management Practices (BMPs) will be implemented during construction.

- Inclement Weather – The project area is located within the existing drainage ditches; therefore, construction should occur during drier months to limit possible flooding of the project area.

- Construction/Demolition Waste – Construction debris and excess materials will be removed from the construction area and disposed of as directed by TVA. A site-specific plan should be developed to coordinate spoil and laydown sites with other projects as needed.

- The KY construction general permit states that construction must be phased in order to minimize disturbance and the period of time that disturbed areas are exposed without stabilization practices. Phasing of the landfill and other projects must be coordinated throughout construction events to ensure no more than 50 acres at one time are disturbed without initiation of stabilization practices in accordance with site best management practices.

7. Key Deliverables for Phase 2

It is expected that the engineering design and regulatory permitting will have parallel and overlapping elements providing efficiency in the approach.

The following is a list of the primary deliverable items for Phase 2 – Design Engineering Services:

- Environmental Assessment
- KDWM Special Waste Permit Application
  - Hydrogeologic Report
  - Design and Operations Narrative and Plans (Permit Plans)
  - Closure/Post-Closure Plan
- Section 401/404 Permit Application and Kentucky Water Quality Certification
- Preparation of Stormwater Pollution Prevention Plan (SWPPP)
- Title V Air Permit Modifications
- Boundary and Topographic Surveys
- Issued for Review (IFR) Plans (30%, 60% and 90%), Specifications, and Construction Quality Assurance Plan
- Issued for Construction (IFC) Plans, Specifications, and Construction Quality Assurance Plan
- Basis of Design Report (including Calculation Package)
- Opinion of Probable Construction Cost
- Permit Drawings
- Updated Stantec Fee Estimate Phase 3
- Contingency Plan

8. Engineering Materials and Construction Contracts

8.1. Engineering Materials

Construction materials for the SHF CCR Landfill will consist of readily available materials such as soil fill, sand, crushed stone, high density polyethylene (HDPE) and reinforced concrete pipe (RCP), precast headwalls, and rip-rap. Based on recent conversations with liner manufacturers, current lead times for special items, including geomembranes, geosynthetic clay liners, and geotextiles, have a typical lead time of less than 120 days. Anticipated project materials are identified in the conceptual design drawings and will be further defined during the design phase.

8.2. Construction Contracts

TVA will utilize their own construction capabilities, use a contractor already on site, or issue a Request for Proposal (RFP) to accomplish the work. The decision on who will perform the work will be made by TVA.

9. Cost Opinion

Stantec has prepared opinions of probable construction cost for the site that is presented in Section 3. The construction, operations, and maintenance cost spreadsheets are included in Attachment B. Costs are considered preliminary and are subject to change as new information is obtained.

10. Schedule

A preliminary schedule for the implementation of the complete scope of work (i.e., design and construction) is presented in Attachment E. The construction schedule is preliminary in nature and implementation will be the responsibility of the Contractor.

11. Drawings

Refer to Attachment F for the following Conceptual Design drawings:

Cover Sheet (10WXXX-01)

Existing Conditions (10WXX-02)

Perimeter Road and Liner Plan (10WXXX-03)

Final Grading and Drainage Plan (10WXXX-04)

Profile – Baseline A (10WXXX-05)

Profile – Baseline B (10WXXX-06)

Details (10WXXX-07)

Details (10WXXX-08)

12. References

Tennessee Valley Authority. December 2014. Shawnee Fossil Plant Units 1 and 4 – Final Environmental Assessment.

Attachment A

Landfill Siting Study

Siting Study Report

New Landfill
TVA Project No. FR609511
Shawnee Fossil Plant
Paducah, McCracken County, Kentucky

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

July 28, 2015

Stantec Consulting Services Inc.
Design with community in mind
www.stantec.com

Stantec Consulting Services Inc.
601 Grassmere Park Road, Suite 22, Nashville, Tennessee 37211

July 28, 2015 rpt_001_172675016

Attention: Mr. Shane Harris
Tennessee Valley Authority
1101 Market Street, LP-5G
Chattanooga, Tennessee 37402-2801

Reference: Siting Study Report
New Landfill
TVA Project No. FR609511
Shawnee Fossil Plant
Paducah, McCracken County, Kentucky

Dear Mr. Harris:

Stantec Consulting Services Inc. (Stantec) is pleased to submit the Siting Study Report for the project referenced above. The report describes the methodology and results associated with the tasks outlined in the Proposal dated February 13, 2015.

Stantec looks forward to continue working with TVA. Please contact us at (615) 885-1144 with any questions.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Richard G. Schuff, P.E.
Principal
rick.schuff@stantec.com

Ashley T. Smith, P.E.
Project Manager
ashley.smith@stantec.com

Siting Study Report

New Landfill
TVA Project No. FR609511
Shawnee Fossil Plant
Paducah, McCracken County, Kentucky

Table of Contents

Section **Page No.**

Table of Contents
(Continued)

List of Tables

List of Appendices

Siting Study Report

New Landfill
TVA Project No. FR609511
Shawnee Fossil Plant
Paducah, McCracken County, Kentucky

Executive Summary

Stantec Consulting Services Inc. (Stantec) has completed a Siting Study for a new landfill for the Tennessee Valley Authority's (TVA) Shawnee coal-fired power plant as set forth in the Proposal dated February 13, 2015. The study included McCracken County, Kentucky and other locations in Western Kentucky.

This study included the identification of potential sites and analysis of their feasibility. Potential sites were identified from TVA property, for-sale properties, not-for-sale properties, and off-site, privately owned landfills. Based on waste generation assumptions, Stantec estimated a need for about a 140 acre footprint, which meant that a viable site needed to be about two to three times that size. Sites were visually identified by review of the parcel data in the vicinity of Shawnee (within five to ten miles), but focusing mostly on sites adjacent or nearly so.

Stantec identified six sites of within 5 miles (including three contiguous to TVA property), and did preliminary evaluation of these based on GIS info. These were presented at Workshop 1. The Joint Project Team (JPT) decided three of these potential sites should receive further consideration, and also added three, third-party disposal sites. Rating and Scoring Criteria were also presented and adopted by the JPT.

The remaining candidate sites, including three new landfill sites and three, third-party alternatives, were further evaluated by Stantec. This was done by using GIS data and other data such as distance from the point of CCR generation, minimum required acreage for a 20-year design life, proximity to public lands and other sensitive resources, and other selected criteria. Review of the candidate sites was performed to assist with the identification of restrictions and/or features that may prohibit landfill siting that were not identified previously. Cost estimates of the remaining six candidate sites were prepared. The sites were then scored and ranked in a range from zero to 100 with weighted input from the following categories: Availability, Location, Geotechnical and Subsurface Conditions, Regulatory Considerations, Design and Construction, Intangibles (opposition), and Economics. At the start of Workshop 2, it was made known that the land for the Option 2 site was not available for purchase, so it was not considered any further. In Workshop 2, the Joint Project Team (JPT) selected the best potential site, Option 1, which is adjacent to the Shawnee Fossil Plant. A large portion of the Option 1 site is under common ownership and was previously marketed as industrial development land.

Since Workshop 2, Stantec has prepared Conceptual Design Plans, a Project Planning Document (PPD), and this Siting Study.

List of Acronyms

CCR	Coal Combustion Residual
CY	Cubic Yard
EST	Estimate
FEMA	Federal Emergency Management Agency
FGD	Flue Gas Desulfurization
FWL	Freedom Waste Landfill
GIS	Geographic Information Systems
JPT	Joint Project Team
KAR	Kentucky Administrative Regulations
KDOW	Kentucky Department of Water
KDWM	Kentucky Division of Waste Management
KY	Kentucky
NEPA	National Environmental Policy Act
PPD	Project Planning Document
PV	Present Value
SCR	Selective Catalytic Reduction
SHF	Shawnee Fossil Plant
TPY	Tons Per Year
TVA	Tennessee Valley Authority
USGS	United States Geological Survey
WKRS	Western Kentucky Regional Services, Inc.
WPL	Waste Path Landfill

1. Introduction

1.1. Background

The Tennessee Valley Authority (TVA) has plans to install selective catalytic reduction (SCR) and flue gas desulfurization (FGD) systems at the Shawnee Fossil Plant (SHF) by December 31, 2017. As a result, TVA will need a new landfill facility to meet increased storage capacity requirements for the coal combustion residuals (CCRs) to be generated by the FGD system. The purpose of this project is to build a new special waste landfill, at a location to serve the Shawnee Fossil Plant, and store CCRs produced during operation of the FGD system at this facility.

The required site size was calculated from the information seen in Table 1.1.

Table 1.1. Waste Generation

	2020-2025		2026-2040		Total 2020-2040	
CCR STREAM[1]	LOWER EST[2]	UPPER EST[2]	LOWER EST	UPPER EST	LOWER EST	UPPER EST
BOTTOM ASH (tpy)	28,600	28,600	28,600	28,600		
FLY ASH (tpy)	247,000	247,000	247,000	247,000		
FGD (tpy)[3]	82,000	219,000	369,000	985,500		
TOTAL (tpy)	357,600	494,600	644,600	1,261,100		
TOTAL DURING PERIOD (tons)	2,145,600	2,967,600	9,024,400	17,644,400	11,170,000	20,623,000
TOTAL DURING PERIOD (cy)	1,990,000	2,750,000	8,355,900	16,347,600	10,342,600	19,095,400

[1]Data from Shawnee Fossil Plant Units 1 & 4 – Final Environmental Assessment
[2]Lower and Upper Estimates based on sources of coal used; lower estimate based on continued use of current coal sources
[3]FGD CCR from units 1&4 (2020-2025) and from all nine units from 2026-2040

A preliminary geometric evaluation was conducted and it determined that an approximately 140 acre footprint would be needed for the new landfill.

1.2. Purpose and Scope

In the Proposal dated February 13, 2015, Stantec identified the Phase I scope. Phase I included the identification of potential landfill sites and consisted of the following tasks:

1) Project Kickoff Meeting and Workshops

2) Siting Study

3) Conceptual (10%) Design of Selected Alternative

4) Project Planning Document

Phase II (to be executed under a separate scope of work) will include geologic, geotechnical and hydrogeologic characterization, engineering design, permitting, preparation of Construction Drawings and Specifications, and related baseline scope and budgets.

1.2.1. Candidate Site Selection

This task involved the identification of candidate landfill sites including TVA-owned property, for-sale properties, not-for-sale properties, and off-site landfill properties. Stantec used GIS and other publicly available data sets to find sites with at least one parcel over 100 acres that are within 10 miles of the Shawnee Fossil Plant, are predominately outside of the floodplain, and have public road access if not adjacent to existing TVA property. Seven sites were identified for the initial site screening.

1.2.2. Initial Site Screening

Initial site screening included the development of maps showing the parcel outline, aerial imagery, USGS topographic contours, wetlands, floodplains, and streams for each candidate site. Using the maps, Stantec screened sites for potential issues related to jurisdictional waters, floodplains, and public road access. Six sites were identified for further evaluation.

1.2.3. Site Evaluation

Site evaluation consisted of the evaluation, scoring, and ranking of remaining candidate sites from the Initial Site Screening task. Stantec evaluated each site based on the following criteria:

- Site availability
- Site location considerations
- Geotechnical and subsurface conditions
- Regulatory considerations
- Design and construction considerations
- Intangible considerations
- Economic considerations

Stantec scored and ranked each site using the scoring system described in Section 4.1.

1.2.4. GIS Data Inventory

Stantec developed a list of GIS data required to identify potential landfill sites. The majority of spatial data was obtained from public domain sources. Table 1.2 lists the GIS data requested and obtained for the siting study.

Table 1.2. GIS Data Inventory

Data	Source	Note
USGS Topographic Mapping	Public Domain	
Aerial Imagery	Public Domain	
Land Use	Public Domain	McCracken County Future Land Use Plan
Transportation	Public Domain	
NRCS Geologic Mapping	Public Domain	
FEMA Floodplains	Public Domain	
Wetlands	Public Domain	
USGS Streams	Public Domain	
Threatened and Endangered Species and Habitats	Public Domain	
Historic and Cultural Sites	Public Domain	
Oil and Gas Well Locations	Public Domain	
Karst Geology	Public Domain	
Groundwater Resources	Public Domain	
Soils	Public Domain	
Public Lands	Public Domain	
Water Wells	Public Domain	
Parcels	McCracken County	Parcel data for McCracken County was purchased

Parcel data was not available from public domains, so it was purchased for McCracken County.

2. Candidate Selection

2.1. Potential Sites

Potential landfill sites included existing TVA property, for-sale properties, not-for-sale properties, and off-site landfill properties. Parcel data was used to identify not-for-sale properties. Appendix D shows the location of the six initial potential landfill sites, as presented to the JPT at Workshop 1. The only site identified by TVA as for sale was the Option 1 site. TVA provided Stantec with a real-estate listing for the for-sale property, and a cost basis was derived for the other site options.

2.2. Permit Modification Option

A permitted Special Waste Landfill is currently being used at SHF for storage of CCRs. Stantec has estimated that there is about 17,500,000 cubic yards of useable capacity in this facility. A permit modification would be required in order to take the new waste stream to the existing landfill for either the short term while a new facility is being developed or as a long term disposal option. This option was considered by the JPT.

2.3. Third-Party Disposal Options

Options were also considered for CCR storage at privately-owned commercial landfills. Three such facilities were identified and are described below.

2.4. Elimination and Reduction of Potential Landfill Sites

The JPT reduced the number of new potential landfill sites at Workshop 1 from six (6) to three (3), (Options 1, 2 and 3). Options 4, 5, and 6 were eliminated based on one or more factors including quantity of useable land, proximity to SHF, current ownership, and likely opposition. Potential sites corresponding to wildlife refuges were also removed.

An option to modify the existing special waste permit at Shawnee was also discussed and eliminated at Workshop 1 by the JPT, due to additional permitting requirements.

Options 1, 2, and 3 would be studied and further evaluated in Workshop 2, along with the three (3) third-party disposal alternatives. However, at the start of Workshop 2, it was made known that Option 2 was not available for purchase; therefore, it was not discussed any further.

3. Site Evaluation

3.1. Site Maps

Site maps were developed for the three remaining new site options using GIS data imported into CAD software. Data displayed on the site maps included streams, wetlands, floodplains, karst data, water wells, oil and gas wells, parcel boundaries, railroads, highways, aerial photography, and USGS topographic quadrangle contours.

3.2. Methodology

The scoring criteria used were adapted from "Regional Siting Study Report, Regional Siting Study, Byproduct Disposal Facilities", Stantec, May 2010. Candidate sites were evaluated relative to one another in a quantitative manner when possible. Some site criteria were qualitative due to the level of investigation and lack of site specific data. For example, soil characteristics and usability are inferred from USGS soil maps and should be considered qualitative until a site specific analysis has been conducted. Other ranking criteria included the presence of wetlands, floodplains, and other NEPA criteria; however, this information will also require site specific studies to verify the presence and extent of those elements during Phase 2. The evaluation criteria for the candidate sites are summarized in the subsections below.

3.2.1. Site Availability

Site availability was given considerable weight by the JPT due to TVA's desire to avoid the need to condemn property. The site availability element primarily involves the ability of TVA to acquire the off-site property or utilize the third-party disposal alternatives, with more consideration given to properties that were already known to the JPT to be available and marketed.

3.2.2. Site Location

The site location element primarily involves the distance from the point of waste generation to the candidate site. This favors adjacent and nearby sites. Consideration was also given to the extent that transfer or haul roads must be either improved by expanding existing roadway infrastructure or created by construction of new roadways. Compatibility with the existing and future land use plan, as well as existing utility corridors was also considered.

3.2.3. Geotechnical and Subsurface Conditions

Because site specific geotechnical and subsurface conditions were not assessed under the current scope of work, various published resources consisting of available geologic mapping, and soil surveys were consulted during this study. Seismic risks were considered equal for all sites. The following geotechnical and subsurface conditions were considered for this study:

- Geology/Underlying Bedrock (Karst potential)
- Soil Suitability for Grading
- General depth to groundwater
- Soil structure
- Unique geologic features

3.2.4. Regulatory Considerations

Regulatory considerations for this study include elements that may potentially affect the ability to obtain construction permits or adhere to operational permits for the candidate facilities and/or its anticipated ancillary features. State regulation elements were selected to evaluate the candidate sites and included the percentage of floodplains and wetlands on the site, and the potential endangered/threatened species listed by county for each site.

A summary of the regulatory guidance is included in Appendix A.

3.2.5. Design and Construction

Design and Construction constraints included a calculation of useable acreage and included omission of mapped wetlands, 100-year flood plains, and required buffers. Site balance and topography were also given scoring inputs and are based on the total amount of relief and the anticipated overburden characteristics for mass grading. Areas of steep topography were given reductions, while sites with obvious borrow areas were scored favorably. The largest percentage of input was tallied from site geometry which was based on the impact of non-useable zones and the overall geometry for site grading. Non-useable zones due to the location of wetlands or floodplains, roadway access and visibility constraints were reviewed with regards to the potential for making the sites infeasible due to their location. Third-party disposal alternatives that are already permitted were considered useable, although their available capacity is unknown.

3.2.6. Intangibles

Intangibles represent those elements which cannot be quantified at this time. For purposes of this study, intangibles represent anticipated opposition to the proposed landfill construction and operation. Anticipated opposition is a subjective element used in the site evaluation to characterize candidate landfill sites on the basis of their expected impact to area property owners and the public at large. Aspects include potential opposition by property owners who are either directly affected by a site (those being purchased) and those owners who are adjacent to a site and affected by operations. Public opposition could potentially come in the form of aesthetic or practical concerns of the operating landfill or through environmental concerns associated with the facility. Sites located near high density populations, cultural/social centers, or historical sites will likely produce more pronounced opposition. Visibility of the operation from such entities or public access corridors will also likely increase opposition. As such, the distance to schools, hospitals, parks and religious centers were weighted to provide quantitative analysis to the candidate sites.

3.2.7. Economic Analysis

In order to evaluate candidate sites, land costs were assumed to be equal for the three off-site options (300 acres at $12,000 per acre). 300 acres was determined to be the necessary minimum land required and $12,000 per acre is the current asking price for Option 1. Hauling costs included trucking and/or barging from the point of generation to the fill area. Present Value (PV) was calculated for a 20-year period with a 4% discount rate. Cost Analyses were based on pre-conceptual design and are shown in in Appendix C.

3.2.8. Environmental Justice

Environmental justice refers to an equitable spatial distribution of burdens and benefits to groups such as racial minorities or residents of economically disadvantaged areas, by county. Since the potential new landfill sites were all within McCracken County, and therefore all would score the same, this category was eliminated from the scoring evaluation prior to Workshop 2.

3.2.9. Scoring and Ranking

Using the elements discussed in Sections 3.2.1 through 3.2.8, each of the candidate sites were ranked using a scoring system based on a range of zero to 100 for each category. The final scoring elements were then grouped to provide a logical assessment of the respective criteria, as determined by the JPT. The categories were also weighted based on perceived importance; the weighting scheme presented in Table 3.1 was adapted for scoring each candidate site.

Table 3.1. Scoring System – Relative Weights

Category	Relative Weight
Site Availability	20%
Site Location	25%
Geotechnical and Subsurface Conditions	5%
Regulatory Considerations	15%
Design and Construction Considerations	5%
Intangibles (Anticipated Opposition)	15%
Economics	15%
Total	**100%**

The sites were first independently scored by the Stantec study team. Scores were assigned under each category based on listings of positive and negative attributes for each sites. Final site ranking was based on the cumulative score for each site. The scores were then reviewed by the JPT at Workshop 2.

3.3. Results

The following results are based on the categories and weighting described above. Summary tables of the results are provided in the following subsections and the scoring and ranking data are included in Appendix B.

3.3.1. Option 1

Option 1 is located east and adjacent to the existing TVA Shawnee property. Access can be direct from TVA property and the distance to the point of generation is about 1 mile. The site is 328 acres, consisting of 14 parcels and 9 owners. There are small areas of wetlands on the site, which are probably not avoidable. There is also an intermittent, possibly avoidable stream. The site is partially located within the documented plume of contamination of the Paducah Gaseous Diffusion Plant, and there are also private wells on the property and adjacent properties. This property is not within the 100-year floodplain, and it does not drain to Metropolis Lake (to which discharges of stormwater are prohibited). The McCracken County Future Land Use Plan shows the entire site as Heavy Industrial, which would be ideal for a CCR landfill. According to TVA Real Estate, the site may still be zoned agricultural; however, TVA does not have to ask for re-zoning approvals. There may be some opposition to the site, as it is about 5 miles northwest an existing school; a natural area is directly adjacent to its southwest side, and has neighboring residential properties immediately to the east. Some of the site is currently being marketed for sale. As shown in Table 3.2, the majority of the scoring criteria ranked Option 1 favorably, with the exception of intangibles due to the existing residential neighbors and natural area near it. A site map for the candidate Option 1 is in Appendix E.1.

Table 3.2. **Summary of Scoring and Ranking – Option 1**

Criteria	Score
Site Availability	**80**
Site Location	**100**
Geotechnical & Subsurface	**95**
Regulatory	**98**
Design & Construction	**81**
Intangibles	**50**
Economics	**100**
Composite Score	**87**
Rank	**1**

3.3.2. Option 2

Option 2 is located southwest and adjacent to the existing TVA Shawnee property. Access can be made directly from TVA property and the distance to the point of generation is about 1.2 miles. The site is 935 acres, consisting of 6 parcels and 1 owner. There are areas of wetlands on the site, which are avoidable due to the size of the site. There are also intermittent and perennial streams, but these can also likely be avoided. There are also private wells on the property and adjacent properties. This property is partially within the 100-year floodplain, but it could likely be avoided. The McCracken County Future Land Use Plan shows most of the site as Heavy Industrial, and some as Agricultural. There may be some opposition to the site, as it is about 3.5 miles from an existing school, directly adjacent to a natural area, and about one and a half miles east of a church. Some of the site was previously marketed for sale, but after discussions with the owner, they are not willing to sell the property at this time. For this reason, the JPT removed this site as a potential option at the beginning of Workshop 2. As shown in Table 3.3 below, Option 2 was still scored, but was not ranked due to its unavailability. The majority of the scoring criteria ranked Option 2 favorably, with the exception of availability and intangibles, due to the existing church, school, and natural area near it. A site map for the candidate Option 2 is in Appendix E.2.

Table 3.3. Summary of Scoring and Ranking – Option 2

Criteria	Score[1]
Site Availability	**0**
Site Location	**99**
Geotechnical & Subsurface	**100**
Regulatory	**91**
Design & Construction	**84**
Intangibles	**70**
Economics	**98**
Composite Score	**73**
Rank	**-**

[1]Option 2 is not ranked because of its removal due to unavailability

3.3.3. Option 3

Option 3 is located southwest of the existing TVA Shawnee property. Access is off Odgen Landing Road and the distance to the point of generation is about 7 miles. The site is 298 acres, consisting of 2 parcels and 2 owners. There is a small area of wetlands on the site, which is avoidable. There are also intermittent streams, but they can also likely be avoided. There are also some private wells on the property and adjacent properties. This property is not within the 100-year floodplain. The McCracken County Future Land Use Plan shows the site as Agricultural. There may be some opposition to the site, as it is about 2.5 miles from an existing school, about three-quarters of a mile southwest of a natural area, and about a half-mile east of a church. The availability of the site is unknown, as it was not previously or currently marketed. As shown in Table 3.4 below, the majority of the scoring criteria ranked Option 3 favorably, with the exception of availability and intangibles, due to the existing church, school, and natural area near it. A site map for the candidate Option 3 is in Appendix E.3.

Table 3.4. Summary of Scoring and Ranking – Option 3

Criteria	Score[1]
Site Availability	**50**
Site Location	**70**
Geotechnical & Subsurface	**100**
Regulatory	**96**
Design & Construction	**79**
Intangibles	**55**
Economics	**93**
Composite Score	**73**
Rank	**3**

[1]Second and Third place tie was broken by two additional decimal places

3.3.4. Western Kentucky Regional Services, Inc. (WKRS)

WKRS is located near Sturgis, KY. This business has a permit to construct a new landfill and dispose of both municipal solid waste and CCRs. No landfill disposal cells have been constructed to date. This site is being marketed by its owner as a landfill with access by barge transport on the Ohio River. The distance to the point of generation is about 76 river miles or 92 road miles. The site is a total of 676 acres, 43 of which are ready for construction for an initial 4.25 million cubic yards of permitted disposal airspace that could be operational within 1 year. There is an existing barge loading facility on site, which would need to be modified for unloading of CCRs from SHF. A loading facility would need to be constructed at Shawnee. The owner quoted a tipping fee of $40/ton, assuming 500,000 tons/year for at least 12 years, which includes all costs after being loaded on the barge at Shawnee. This is a rural site with no zoning, so the only anticipated opposition would be from nearby residential properties. As shown in Table 3.5 below, the majority of the scoring criteria ranked WKRS favorably, with the exception of site location and economics.

Table 3.5. Summary of Scoring and Ranking – WKRS

Criteria	Score[1]
Site Availability	**100**
Site Location	**42**
Geotechnical & Subsurface	**100**
Regulatory	**99**
Design & Construction	**84**
Intangibles	**90**
Economics	**35**
Composite Score	**73**
Rank	**2**

[1]Second and Third place tie was broken by two additional decimal places

3.3.5. Freedom Waste (Western Kentucky) Landfill, Mayfield, KY (FWL)

FWL (also known as Western Kentucky Landfill) is located in Mayfield, KY. Access is via public roads and the distance to the point of generation is about 32 miles. This is an existing third-party disposal site. The site size is unknown, but it is assumed to be feasible since it is a permitted site. A tipping fee quote of $32/ton was recently received from the site owner. There is a nearby residential neighborhood and school, and although it is an existing landfill, this could make the site less desirable. As shown in Table 3.6 below, the majority of the scoring criteria ranked FWL unfavorably, with the exception of geotechnical and regulatory, since it is currently a permitted landfill.

Table 3.6. Summary of Scoring and Ranking – Freedom Waste Landfill

Criteria	Score
Site Availability	**60**
Site Location	**55**
Geotechnical & Subsurface	**100**
Regulatory	**100**
Design & Construction	**84**
Intangibles	**75**
Economics	**35**
Composite Score	**66**
Rank	**5**

3.3.6. Waste Path Landfill, Calvert City, KY (WPL)

WPL is located in Calvert City, KY. Access is via public roads and the distance to the point of generation is about 32 miles. This is an existing third-party disposal site. The site size is unknown, but it is assumed to be feasible since it is a permitted site. The tipping fee used for the economic analysis was assumed to be $32/ton (comparable to that of FWL). As shown in Table 3.7 below, the majority of the scoring criteria ranked WPL unfavorably, with the exception of geotechnical and regulatory, since it is currently a permitted landfill.

Table 3.7. Summary of Scoring and Ranking – Waste Path Landfill

Criteria	Score
Site Availability	**60**
Site Location	**55**
Geotechnical & Subsurface	**100**
Regulatory	**99**
Design & Construction	**84**
Intangibles	**100**
Economics	**41**
Composite Score	**71**
Rank	**4**

3.3.7. Rail Transportation

At the request of TVA during Workshop 2, consideration was given to the option of hauling CCRs by rail to an offsite third-party landfill. This option would entail loading of railcars at SHF, hauling cars to a siding at an offsite landfill, unloading and trucking to the tipping face. This handing is considered comparable to the barge haul alternative that is included in the WKRS Option. A separate quote of $3.10/ton was received from Crounse Corporation for barging the waste about 72 miles. Assuming the rail cost would be no less than this amount, offsite third-party disposal would still be more than twice as expensive over the life of the project as either of the TVA new site development options. No further consideration was given to this option.

4. Conclusions and Recommendations

Six alternatives were evaluated, scored and ranked for the long-term storage of CCRs, as shown in Table 4.1 (with the exception of Option 2 being unranked). The results for each individual alternative were discussed in the previous section; however, many alternatives shared common advantages or drawbacks.

Table 4.1. Final Summary of Scoring and Ranking of Alternative Sites

Rank	Site	Score[1]
1	Option 1	**87**
2	WKRS	**73**
3	Option 3	**73**
-	Option2[2]	**73**
4	Waste Path Landfill	**71**
5	Freedom Waste Landfill	**66**

[1]Second and Third place tie was broken by two additional decimal places
[2]Option 2 is not ranked because of its removal due to unavailability

Two alternatives (Option 1 and 2) were adjacent to the existing TVA Shawnee property, so access could be by private internal haul road, while minimizing public interaction. Due to the favorable location, the hauling distance was minimized, which also contributed a financial advantage. Option 3 was within 10 miles of Shawnee, so it also had the benefit of a closer location. These three alternatives also avoid the tipping and hauling costs that the third-party disposal alternatives require.

While potential sites were initially chosen based on the size of the parcels, proximity to Shawnee, amount of floodplain, and road access, Option 2 had the most acreage. This allowed streams and floodplain impacts to be avoided, although their presence somewhat impacted the regulatory analysis. However, this site was removed from consideration because the property will not be available for purchase.

Very few sites scored highly in the intangibles, except for two third-party alternative sites located in rural areas (WKRS, WPL), away from most schools, churches, residential neighborhoods, and natural areas.

From an economic standpoint, the three third-party disposal alternatives were 2.5 to 3 times more expensive over the project life than the three nearby alternatives (Options 1, 2, and 3).

The JPT selected Option 1 as the best potential site, which is adjacent to Shawnee. In addition to being contiguous and the most cost-efficient alternative, the majority of the site is available for sale, has minimal amount of streams, and no floodplain is present on the site. As such we offer one recommended candidate that in our estimation will provide the most likely site for the respective CCRs landfill. It is critical to note that the success of the recommended site will hinge on the ability of TVA to acquire the necessary parcels. Once access has been obtained, Phase II (executed under a separate scope of work) will include geotechnical/hydrogeologic investigations and NEPA evaluations to confirm site suitability and design and permitting to obtain the necessary regulatory approvals. The recommended candidate site and preliminary landfill layout is shown in Appendix F.

5. References

Stantec. May 2010. Regional Siting Study Report, Regional Siting Study, Byproduct Disposal Facilities.

Tennessee Valley Authority. December 2014. Shawnee Fossil Plant Units 1 and 4 – Final Environmental Assessment.

Appendix A

Regulatory Guide

The following narrative is intended solely to provide a general overview of the regulatory setting based on recent experience and professional engineering opinion.

Regulatory considerations made for this study include elements that may potentially affect the ability to obtain construction permits or adhere to operational permits for the candidate facilities and/or its anticipated ancillary features for Kentucky.

Kentucky
All landfill facilities permitted in Kentucky will be under the jurisdiction of the Kentucky – Division of Waste Management (KDWM). Based on Stantec's experience with similar facilities, the proposed gypsum waste stream will be classified as special waste and will be regulated by Title 401 of the Kentucky Administrative Regulations, Chapter 45 (401 KAR 45). Siting criteria for selecting the location of a special waste landfill are identified in 401 KAR 45:130. In addition, 401 KAR 45:110 lists design requirements for special waste landfills that need be taken into account when evaluating potential landfill sites. Specifically, 401 KAR 45:110, Section 1 states that the design shall comply with 401 KAR 30:031 (Environmental Performance Standards). Copies of these regulations can be found at http://www.lrc.state.ky.us/kar/TITLE401.HTM.

In general, the following criteria were adapted from portions of the special waste regulations and were considered as primary special waste permit elements in this study:

- *Special waste shall not be placed within 250 feet of an intermittent or perennial stream without appropriate water quality certification (It should be noted that, based on Stantec's experience with other permitting projects, the Kentucky Division of Water (KDOW) does not require any water quality certification unless construction occurs within an intermittent or perennial stream).*
- *The 100-year floodplain or an area that will reduce the temporary water storage capacity of the floodplain. Special waste must also not be placed in such a manner as to result in washout of waste due to flood waters.*
- *Special waste shall not be placed within a wetlands area.*
- *Special waste shall not be placed within an area where the uppermost aquifer cannot be monitored or, if necessary, receive corrective action.*
- *Special waste shall not be placed within the zone of collapse of deep-mine workings or within the critical-angle of draw of such workings.*
- *Special waste shall not be placed within 250 feet of a sinkhole or other karst feature.*
- *Special waste shall not be placed within 100 feet of the subject property line.*

Additionally, a special waste facility shall not:

- *cause or contribute to the taking of any endangered, threatened or candidate species;*

- *destroy or adversely modify the habitat of any endangered, threatened or candidate species;*
  - *cause a discharge of pollutants into waters that violate Kentucky surface water standards and environmental regulations;*
  - *cause a discharge of dredged or fill materials into waters without proper certification or permitting; and*
  - *contaminate an underground drinking source in excess of the maximum contaminant levels specified in 401 KAR Chapter 8.*

Appendix B

Scoring and Ranking Tables

Category	Relative Weight (%)	Input Factors
Site Availability	20	Known available=100 pts, unwilling sellers=0, Limited or no information available=30-80 (based on number of parcels needed and amount of info available)
Site Location	25	Proximity = 50 pts, road access = 20 pts, compatibility with surrounding land = 20 pts, impacts due to site utilities = 10 pts.
Geotechnical and Subsurface Conditions	5	Underlying Bedrock = 30 pts (karst, shallow rock), soil cover and suitability for grading = 40 pts, depth to groundwater = 20 pts, structure = 20 pts, unique negative features subtraction of up to 15 pts
Regulatory Considerations	15	Wetlands = 20 pts, Floodplains = 20 pts, perennial/intermittent streams = 20 pts, threatened or endangered species = 10 pts, cemetaries = 10 pts, sinkholes/caves/springs = 20 pts
Design and Construction Considerations	5	Non usable zones = 20 pts, site balance = 25 pts, room for setbacks/ash/geometry = 40 pts, severe topography = 15 pts.
Intangibles (Opposition)	15	School = 20 pts, Hospital = 20 pts., Park/Natural Areas = 20 pts, Church = 20 pts., Residential Subdivisions = 20 pts
Economics	15	Purchase Cost + Infrastructure Improvements + Operation & Maintenance (100 pts, relative)

Overall Ranking and Scoring

Site ID	Site Availability	weight 20%	Site Location	weight 25%	Geotechnical & Subsurface	weight 5%	Regulatory	weight 15%	Design & Construction	weight 5%	Intangibles (opposition)	weight 15%	Economics	weight 15%	Total Score[1]
Option 1	80	16	100	25	95	5	98	15	81	4	50	8	100	15	**87**
Option 2	0	0	99	25	100	5	91	14	84	4	70	11	98	15	**73**
Option 3	50	10	70	18	100	5	96	14	79	4	55	8	93	14	**73**
Western Kentucky Regional Services, Inc.	100	20	42	11	100	5	99	15	84	4	90	14	35	5	**73**
Freedom Waste Landfill, Mayfield, KY	60	12	55	14	100	5	100	15	84	4	75	11	35	5	**66**
Waste Path Landfill, Calvert City, KY	60	12	55	14	100	5	99	15	84	4	100	15	41	6	**71**

Notes:
[1] Weights are shown as rounded, but the Total Score sums exact weight values.

Site ID	Miles from plant	Proximity[1]	Road Access[2]	Compatibility with land use[3]	Utility Corridor Impacts[4]	Location Score
Option 1	1	50	20	20	10	**100**
Option 2	1	50	20	19	10	**99**
Option 3	7	35	10	15	10	**70**
Western Kentucky Regional Services, Inc.	76	10	2	20	10	**42**
Freedom Waste Landfill, Mayfield, KY	32	20	5	20	10	**55**
Waste Path Landfill, Calvert City, KY	32	20	5	20	10	**55**

Notes:
[1] If distance is 0-5 mi, 50 pts; 5-10 mi, 35 pts; 10-50 mi, 20 pts; 50-100 mi, 10 pts
[2] If adjacent, 20 pts; within 10 miles, 10 pts; if within 50 miles, 5 pts; if within 100 miles,2 pts
[3] 20 possible points based on land use plan
[4] If no impacts,10 pts; Minor, 5 pts; Major, 0 pts

Site ID	Geology/ Underlying Bedrock[1]	Soil Suitability to Grading[2]	Anticipated Groundwater Depth[3]	Soil Structure[4]	Unique Negative Features[5]	Geotechnical Score
Option 1	30	30	20	20	5	**95**
Option 2	30	30	20	20	0	**100**
Option 3	30	30	20	20	0	**100**
Western Kentucky Regional Services, Inc.	30	30	20	20	0	**100**
Freedom Waste Landfill, Mayfield, KY	30	30	20	20	0	**100**
Waste Path Landfill, Calvert City, KY	30	30	20	20	0	**100**

Notes:

[1] 30 Total Points Available: -15 to -10 for Karst, -10 for Shallow Rock

[2] 40 Total Points Available: -10 for Silt, -10 for Alluvial, -10 for thin <10 feet, -10 for Colluvium, -5 for Hydric

[3] Deep (50+ feet) = 20, Moderate = 15, Shallow (<20 feet) = 10

[4] Flat Lying, no Structure=20, Some Dip = 15, Severe=5

[5] None = 0, Variable up to 15 Points Deduction

Regulatory

Site ID	Wetlands[1]	Floodplains[2]	Streams L.F.	Streams Contribution[3]	# of Endangered Species (by County)[4]	Endangered Species Contribution[5]	Cemetaries[6]	Karst Features Contribution[7]	Regulatory Score
Option 1	19	20	505	20	12	8.8	10	20	**98**
Option 2	19	19	14,957	15	12	8.8	10	20	**91**
Option 3	20	20	4,994	17.5	12	8.8	10	20	**96**
Western Kentucky Regional Services, Inc.	20	20	0	20	11	8.9	10	20	**99**
Freedom Waste Landfill, Mayfield, KY	20	20	0	20	3	9.7	10	20	**100**
Waste Path Landfill, Calvert City, KY	20	20	0	20	12	8.8	10	20	**99**

Notes:
[1] Percentage of wetlands by order of magnitude (20 pts)
[2] Percentage of floodplains by order of magnitude (20 pts)
[3] If stream LF is <1000, 20 pts; <5000, 17.5 pts, <15000, 15 pts; <25000, 10 pts
[4] Includes Endangered and Threatened Species
[5] (100 - # of Endangered/Threatened Species/10) by order of magnitude (10 pts)
[6] 10 pts if none on site, 0 pts if on site
[7] If no known karst = 20 pts; mapped sinkhole = 15 pts; named sinkhole or spring = 10 pts, named cave = 5 pts

Design and Construction

Site ID	Acreage	Acreage After Buffers	Buffer %	Useable land[1]	Site Balance[2]	Space for Setbacks/ Ash/Geometry[3]	Topography[4]	Design and Construction Score
Option 1	328	298	9%	16	20	35	10	**81**
Option 2	935	650	31%	19	20	35	10	**84**
Option 3	298	209	30%	14	20	35	10	**79**
Western Kentucky Regional Services, Inc.			0%	19	20	35	10	**84**
Freedom Waste Landfill, Mayfield, KY			0%	19	20	35	10	**84**
Waste Path Landfill, Calvert City, KY			0%	19	20	35	10	**84**

Notes:
[1] 20 possible points - Larger sites with less buffers scored higher, Permitted sites assumed to be adequate
[2] 25 possible points - All sites scored down because of limited data available to distinguish between them and no site is expected to be perfect
[3] 40 possible points - All sites scored down because of limited data available to distinguish between them and no site is expected to be perfect
[4] 15 possible points - All sites scored down because of limited data available to distinguish between them and no site is expected to be perfect

Intangibles

Site ID	School (miles)[1]	Value	Hospital (miles)[1]	Value	Park/Natural Areas (miles)[1]	Value	Church (miles)[1]	Value	Residential Subdivisions (miles)[1]	Value	Intangible Score
Option 1	5	20	11.5	20	0.1	0	1.4	10	0.1	0	**50**
Option 2	3.5	20	12.9	20	0.1	0	1.5	15	1.5	15	**70**
Option 3	2.5	20	14	20	0.8	5	0.6	5	0.75	5	**55**
Western Kentucky Regional Services, Inc.	6	20	18.6	20	13	20	4	20	1	10	**90**
Freedom Waste Landfill, Mayfield, KY	2.3	20	4.2	20	6	20	2	15	0.2	0	**75**
Waste Path Landfill, Calvert City, KY	5	20	17.1	20	6.5	20	6	20	7	20	**100**

Notes:
[1] If distance is <0.5 mi, 0 pts; <1.0 mi, 5 pts; <1.5 mi, 10 pts; <=2.0 mi, 15 pts; >2.0 mi, 20 pts

Economics

Site ID	Land Cost[1]	Construction Cost[2]	Annual Operation and Maintenance Costs: Hauling Cost[3]	Annual Operation and Maintenance Costs: LF O&M Cost	Annual Operation and Maintenance Costs: Tipping Fee[4]	Annual Operation and Maintenance Costs: Total Annual O&M	PV-O&M[5] (20 yrs)	Economics Total	Economics Score[6]
Option 1	$ 3,600,000	$ 105,348,000	$ 4,296,926	$ 3,400,000	$ -	$ 7,696,926	$ 104,603,742	$ 213,551,742	**100**
Option 2	$ 3,600,000	$ 105,335,000	$ 4,627,459	$ 3,400,000	$ -	$ 8,027,459	$ 109,095,790	$ 218,030,790	**98**
Option 3	$ 3,600,000	$ 106,765,000	$ 5,288,525	$ 3,400,000	$ -	$ 8,688,525	$ 118,079,887	$ 228,444,887	**93**
Western Kentucky Regional Services, Inc.	$ -	$ -	$ 14,873,976	$ -	$ 30,528,000	$ 45,401,976	$ 617,027,671	$ 617,027,671	**35**
Freedom Waste Landfill, Mayfield, KY	$ -	$ -	$ 14,873,976	$ -	$ 30,528,000	$ 45,401,976	$ 617,027,671	$ 617,027,671	**35**
Waste Path Landfill, Calvert City, KY	$ -	$ -	$ -	$ -	$ 38,160,000	$ 38,160,000	$ 518,606,853	$ 518,606,853	**41**

Notes:
[1] Land costs assumed to be 300 acres at $12,000 per acre
[2] Construction costs calculated in Appendix C of the Siting Study
[3] Hauling Costs include trucking and/or barging from point of generation to fill area
[4] Tipping Fee $40/ton (WKRS); $32/ton (FWL, WPL)
[5] Present Value (PV) calculated for 20-year period with 4% discount rate
[6] Economics Score based on 100 points for lowest cost option and others at 100 * (lowest cost/the option cost)

Appendix C

Alternative Construction Cost Analyses

	Units	Option 1	Option 2	Option 3	Freedom Waste (w. KY LF)	Waste Path	WKRS	Notes
Hauling Cost								
Truck Capacity	cy/trip	16.5	16.5	16.5	16.5	16.5		
Average Speed	mph	15	15	25	50	50		
One Way Road Distance	miles	1.1	1.3	3.2	31	31		
Round Trip Distance	miles	2.2	2.6	6.4	62	62		
Wait Time	hrs/trip	0.25	0.25	0.25	0.25	0.25		
Round Trip Time	hrs	0.40	0.42	0.51	1.49	1.49		
Drive hrs/day/truck	hrs	7.5	7.5	7.5	7.5	7.5		
Trips/Day/Truck	Trips (rounded down)	18	17	14	5	5		
Daily Production per Truck	cy/truck/day	297	280.5	231	82.5	82.5		
Average Daily CCR Production (max case)	cy/yr	954,000	954,000	954,000	954,000	954,000	954,000	
LF Operating Days/wk	days/wk	5	5	5	5	5		
Operating Days/yr	days/yr	260	260	260	260	260		
Daily Haul Quantity Required	cy/day	3,669	3,669	3,669	3,669	3,669		
Trucks Needed	number (rounded up)	13	14	16	45	45		
Labor Hours/Day	hrs/day	104	112	128	360	360		# of trucks x 8
Trucking Cost	$/hr	$ 158.91	$ 158.91	$ 158.91	$ 158.91	$ 158.91		Means-Crew B-34C (subcontracted w/equip cost and O&P)
Total Hauling Cost per day	$/day	$ 16,526.64	$ 17,797.92	$ 20,340.48	$ 57,207.60	$ 57,207.60		
Hauling Cost /cy	$/cy	$ 4.50	$ 4.85	$ 5.54	$ 15.59	$ 15.59		
Hauling Cost per CY per mile (one way)	$/cy/mi	$ 4.09	$ 3.73	$ 1.73	$ 0.50	$ 0.50		
Annual O&M Costs								
Truck Haul Cost	$/yr	$ 4,296,926	$ 4,627,459	$ 5,288,525	$ 14,873,976	$ 14,873,976	$ -	
Barge Load Cost	$/yr						$ 249,600	4 employees at $30/hr
Barge Haul Cost	$/cy						$ -	included in WKRS tipping fee
Barge Haul Annual Cost	$/yr						$ -	
Barge Unloading Cost	$/cy						$ -	
Barge Unloading Annual Cost	Y/yr						$ -	included in WKRS tipping fee
Tipping Fee	$/cy				$ 32.00	$ 32.00	$ 40.00	assumes significant gate rate discount for volume
Tipping Fee	$/yr				$ 30,528,000	$ 30,528,000	$ 38,160,000	
Annual LF O&M Cost	$/yr	$ 3,400,000	$ 3,400,000	$ 3,400,000				
Haul+Tip+LF O&M	$/yr	$ 7,696,926	$ 8,027,459	$ 8,688,525	$ 45,401,976	$ 45,401,976	$ 38,160,000	
interest (discount) rate	%/yr	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	borrowing rate - inflation rate
# of Periods	yrs	20	20	20	20	20	20	
Present Value (PV) of Annual Costs	$	$ 104,603,742	$ 109,095,790	$ 118,079,887	$ 617,027,671	$ 617,027,671	$ 518,606,853	
Capital Costs								
LF Capital Construction	$	$ 105,348,000	$ 105,335,000	$ 106,765,000	$ -	$ -	$ -	
Land Costs	$	$ 3,600,000	$ 3,600,000	$ 3,600,000				300 acres assumed for new LF at $12,000/acre (list price)
Barge Loading Facility	$						$ 4,000,000	$3-5 MM per Bruce Knipe (WKRS)
Total	$	$ 108,948,000	$ 108,935,000	$ 110,365,000	$ -	$ -	$ 4,000,000	
Total Present Value	$	$ 213,551,742	$ 218,030,790	$ 228,444,887	$ 617,027,671	$ 617,027,671	$ 522,606,853	

Note:
WKRS hauling cost is from barge unload to landfill

Summary of Present Value Analysis of Alternatives

	Option 1	Option 2	Option 3	Freedom Waste (W KY LF)	Waste Path	WKRS
Capital Costs						
Landfill	$ 105,348,000	$ 105,335,000	$ 106,765,000			
Barge Loading Facility						$ 4,000,000
Land Costs	$ 3,600,000	$ 3,600,000	$ 3,600,000			
Total Capital Cost	$ 108,948,000	$ 108,935,000	$ 110,365,000	$ -	$ -	$ 4,000,000
Annual Cost						
Truck Haul Cost	$ 4,296,926	$ 4,627,459	$ 5,288,525	$ 14,873,976	$ 14,873,976	$ -
Barge Haul Costs						$ -
Tipping Fees				$ 30,528,000	$ 30,528,000	$ 38,160,000
LF O&M Costs	$ 3,400,000	$ 3,400,000	$ 3,400,000			
Total Annual Costs	$ 7,696,926	$ 8,027,459	$ 8,688,525	$ 45,401,976	$ 45,401,976	$ 38,160,000
PV of Annual Costs	$ 104,603,742	$ 109,095,790	$ 118,079,887	$ 617,027,671	$ 617,027,671	$ 518,606,853
Capital Cost	$ 108,948,000	$ 108,935,000	$ 110,365,000	$ -	$ -	$ 4,000,000
Total PV	$ 213,551,742	$ 218,030,790	$ 228,444,887	$ 617,027,671	$ 617,027,671	$ 522,606,853

Tipping Fees Assumed Heavily Discounted to $15/cy
Barge Haul Cost Assumed to be $10/CY

Shawnee Fossil Plant
Coal Combustion Products Landfill Siting Study
Issued for Review - 7/08/2015

Preliminary Opinion of Construction Costs - Site Option 1

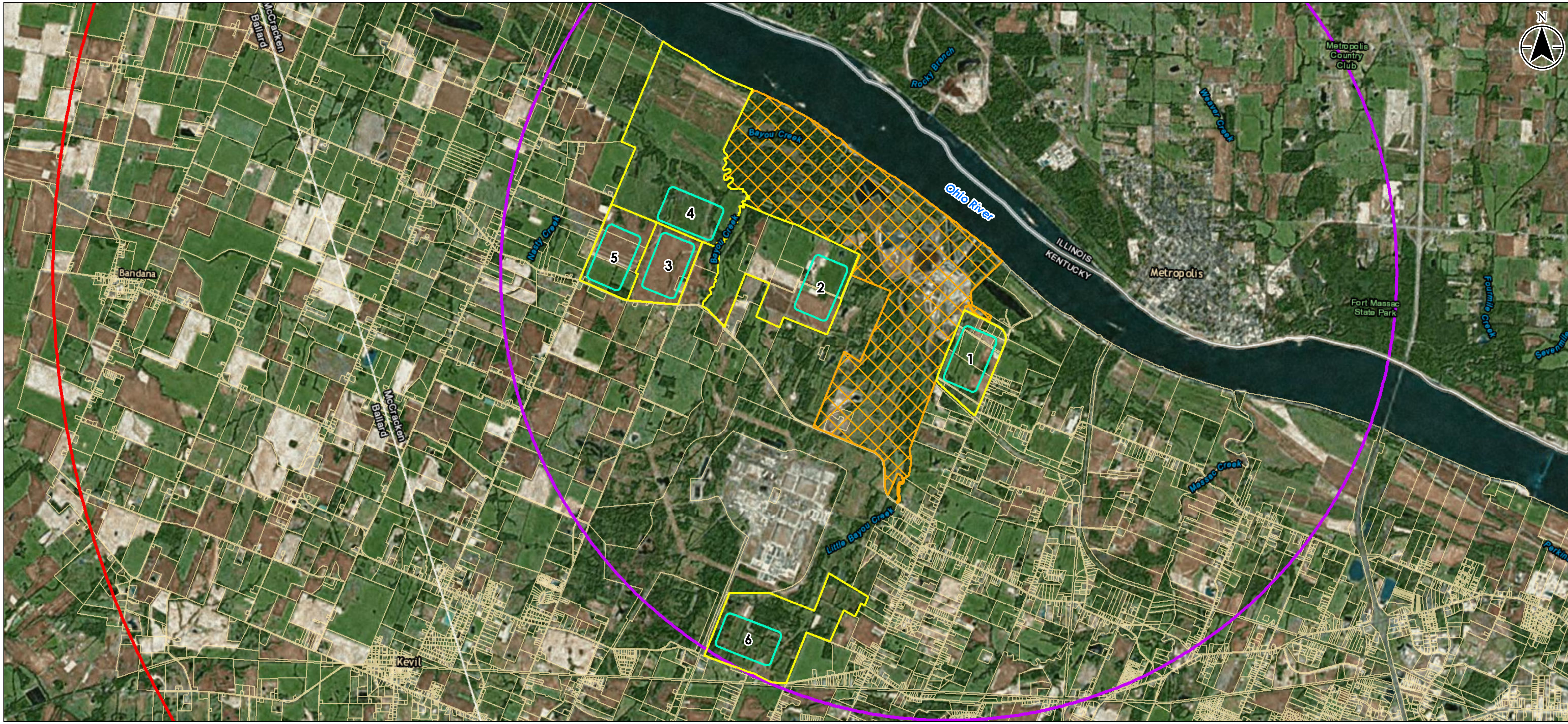
Proj. Location: Paducah, Kentucky	**_Job No:_**	172675016	**_Prepared By:_**	RGS
Date: 7/8/2015	**_Est. Class:_** (Ph. 1)		**_Reviewed By:_**	ATS

Task	Unit	Quantity	Unit Cost (Includes material,	Total Cost
Coal Combustion Products Landfill				
Mobilization/Demobilization (~5% of Const. Total)	LS	1	$2,916,448.92	$ 2,916,449
Site Preparation				
Clearing, Grubbing - Wooded	AC	16	$7,175.00	$ 114,800
Stripping of Topsoil	CY	129,067	$0.89	$ 114,869
Access Road (8,000 LF, 30' wide surface, 40' top width)				
Stripping of Topsoil	CY	5,926	$0.89	$ 5,274
Soil Fill	CY		$6.00	$ -
Geotextile (35' width)	SF	280,000	$0.30	$ 84,000
Crusher Run (30' width, 4" depth @ 1.5 Tons/CY)	TON	4,444	$30.00	$ 133,333
No. 2 Stone (35' width, 12" depth @1.5 Tons/CY)	TON	15,556	$30.00	$ 466,667
Seeding and Mulching	AC	0.9	$3,000.00	$ 2,755
Perimeter Road (10,400 LF, 40' wide surface, 50' top width)				
Soil Excavation	CY	260,000	$3.00	$ 780,000
Soil Fill	CY	260,000	$6.00	$ 1,560,000
Geotextile (45' width)	SF	468,000	$0.30	$ 140,400
Crusher Run (40' width, 4" depth @ 1.5 Tons/CY)	TON	7,704	$30.00	$ 231,111
No. 2 Stone (45' width, 12" depth @1.5 Tons/CY)	TON	26,000	$30.00	$ 780,000
Seeding and Mulching	AC	16	$3,000.00	$ 48,000
Subgrade Preparation				
Rock Excavation	CY	0	$16.00	$ -
Soil Excavation	CY	1,490,000	$3.00	$ 4,470,000
Soil Fill	CY		$6.00	$ -
Liner & Leachate Collection Systems (144 Acres)				
Compacted Soil Liner: 24" of 1 x 10^{-5} Material	CY	464,640	$15.00	$ 6,969,600
Geosynthetic Clay Liner (GCL)	SF	6,272,640	$0.55	$ 3,449,952
60-mil HDPE Textured (FML)	SF	6,272,640	$0.80	$ 5,018,112
Geotextile Cushion	SF	6,272,640	$0.30	$ 1,881,792
Drainage Layer (12" of No. 57 Stone)	CY	232,320	$30.00	$ 6,969,600
HDPE Drainage Header Piping, Geotextile and Stone	LF	57,120	$37.00	$ 2,113,440
Separation Geotextile Fabric	SF	6,272,640	$0.30	$ 1,881,792
Protective Cover: 12" of CCP	CY	232,320	$5.00	$ 1,161,600
Leachate/Contact Stormwater Conveyance				
Pond				
Earthwork	CY	24,200	$5.00	$ 121,000
Compacted Soil Liner: 24" of 1 x 10^{-5} Material	CY	3,227	$15.00	$ 48,400
60-mil HDPE Textured (2 Layers) (FML)	SF	87,120	$0.80	$ 69,696
Geocomposite Drainage Layer	SF	43,560	$0.85	$ 37,026
Outlet Structure	EA	1	$15,000.00	$ 15,000
Leak Collection Pipe	LF	200	$50.00	$ 10,000
Leak Observation Point Manhole	EA	2	$5,000.00	$ 10,000
Leachate Conveyance	LS	1	$1,500,000.00	$ 1,500,000

Task	Unit	Quantity	Unit Cost (Includes material,	Total Cost
Sediment Control				
Sediment Control Ponds (assume 2 @ 3.3 acre)				
Earthwork	CY	50,000	$5.00	$ 250,000
Outlet Structure	EA	2	$15,000.00	$ 30,000
General E & S Control	AC	56	$8,000.00	$ 448,000
Perimeter Surface Ditches (Run-On/Run-Off)				
Excavation	CY	Included in General Earthwork		
Rip-Rap Drainage Channel (Channels >8%)	LF		$60.00	$ -
Grass-Lined Channels	LF	10,400	$20.00	$ 208,000
Diversion Berm	LF	21,600	$30.00	$ 648,000
Down Drain Pipes (18"-24" Typ.)	LF	4,500	$40.00	$ 180,000
Seeding and Mulching	AC		$3,000.00	$ -
Cap (144 Acres)				
Landfill Cap: 6" Vegetative Cover	CY	116,167	$9.00	$ 1,045,500
Landfill Cap: 18" Protective Cover	CY	348,500	$9.00	$ 3,136,500
Geocomposite Drainage Layer	SF	6,273,000	$0.85	$ 5,332,050
40-mil LLDPE Textured (FML)	SF	6,273,000	$0.60	$ 3,763,800
Cover Soil: 12" (Intermediate Cover)	CY	232,101	$9.00	$ 2,088,909
Seeding and Mulching	AC	144	$3,000.00	$ 432,000
Mitigation				
Cultural Resources	EA			$ -
Stream Mitigation	LF	600	$240.00	$ 144,000
Wetlands	AC	0	$29,000.00	$ -
Monitoring				
Monitoring Wells	EA	6	$5,000.00	$ 30,000
Ancillary Facilities				
Building (Office Trailer)	EA	1	$25,000.00	$ 25,000
Truck Wash	EA	1	$50,000.00	$ 50,000
Fencing	LF	15,000	$25.00	$ 375,000
Power	EA	1	$50,000.00	$ 50,000
Sanitary (Septic Tank/Field Lines)	EA	1	$8,000.00	$ 8,000
Water (3" routed from Metropolis Lake Road)	LF	2,000	$20.00	$ 40,000
Permitting and Design Costs				
Engineering/Permitting, Design (@10% of construction)	LS	1	$5,847,297.83	$ 5,847,298
TVA Engineering Costs				
Construction Oversight (@ 10% of Construction Costs)	LS	1	$5,847,297.83	$ 5,847,298
Project Management (@ 5% of Construction Costs)	LS	1	$2,923,648.92	$ 2,923,649
Field Engineering/CQA				
Construction Adm/Monitoring - Liner	Mo	36	$65,000.00	$ 2,340,000
Conformance Surveying - Liner	Mo	36	$5,000.00	$ 180,000
Construction Adm/Monitoring - Cap	Mo	36	$65,000.00	$ 2,340,000
Conformance Surveying - Cap	Mo	36	$5,000.00	$ 180,000
			Option 1 Construction Subtotal	**$ 81,047,672**
			Contingency (30% of Subtotal)	**$ 24,300,000**
			Option 1 Construction Total	**$ 105,348,000**

Appendix D

Potential Landfill Sites



Legend

- Proposed Landfill Foot Print
- Site Boundary
- TVA Property
- 5-Mile Radius
- 10-Mile Radius
- Parcel Boundary

0 3,000 6,000 12,000 Feet

1:72,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1927 StatePlane Kentucky South FIPS 1602
2. Base Map Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
   Esri, HERE, DeLorme, TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Stantec TVA

Project Location 172675016
Paducah
McCracken County, Kentucky
Prepared by WSW on 2015-07-09
Technical Review by AS on 2015-07-09
Independent Review by MS on 2015-07-09

Client/Project
Tennessee Valley Authority (TVA)
Shawnee Fossil Plant
New Landfill Siting Study

Figure No.
1

Title
Six Initial Off-Site Landfill Sites

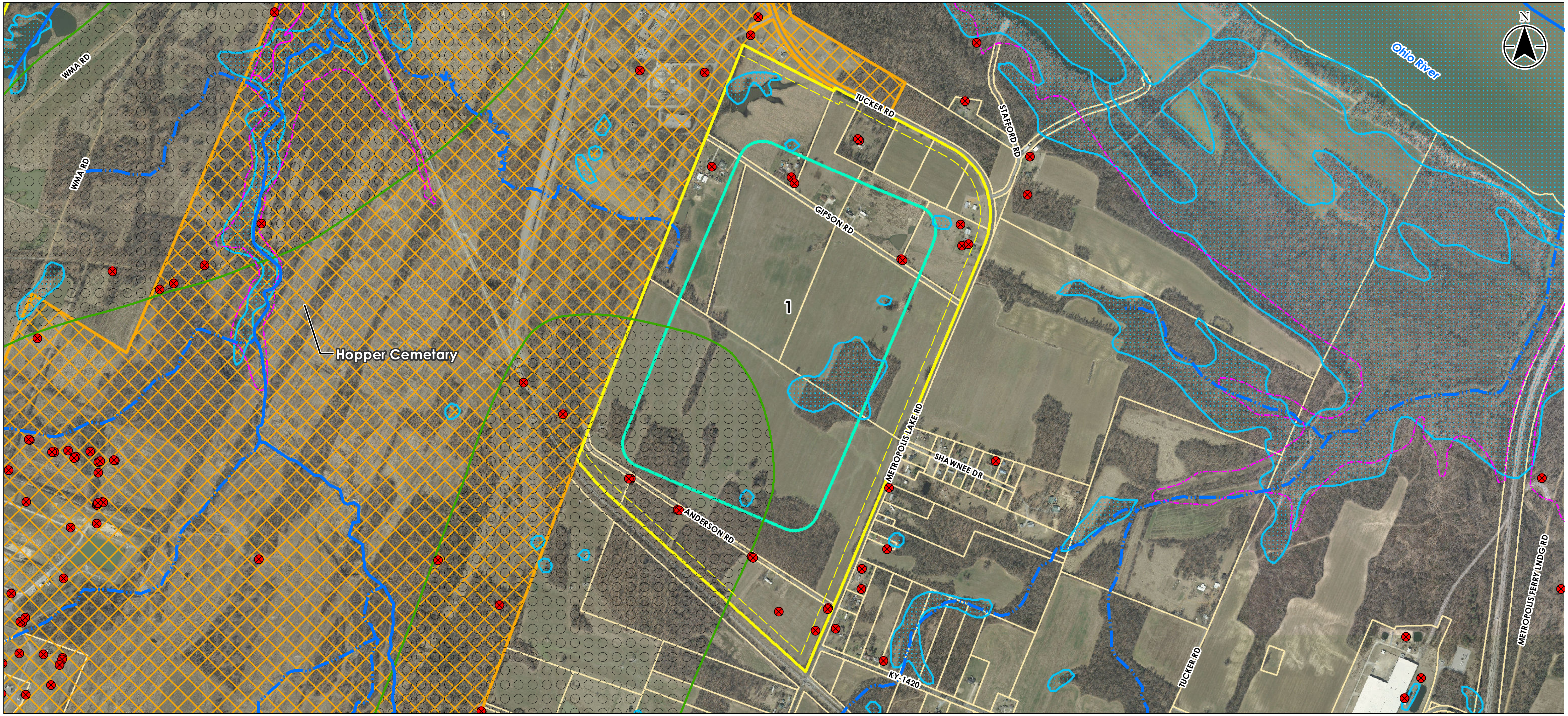
Z:\172675016\MXDs\Fig1.mxd Revised: 2015-07-09 By: swheatley

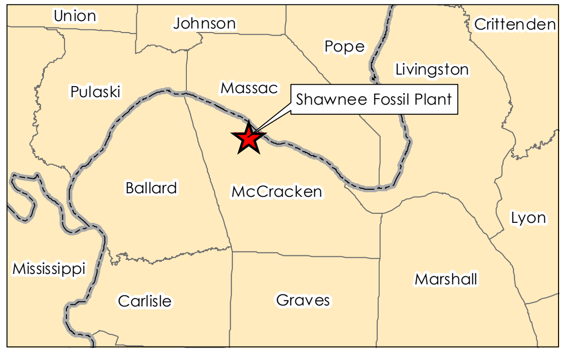
Appendix E

Site Maps

Appendix E.1

Option 1 Site





Notes

1. Coordinate System: NAD 1983 StatePlane Kentucky South FIPS 1602 Feet
2. Imagery Courtesy of KyFromAbove (KYAPED) (Dated 2013)

Legend

- Water Well
- Stream (Intermittent)
- Stream (Perennial)
- 100-Year Floodplain
- Property Line Setback (100')
- Proposed Landfill Foot Print (140 Acre LF Foot Print)
- Site Boundary
- TVA Property
- 5-Mile Radius
- 10-Mile Radius
- Parcel
- Groundwater Plume
- NWI Wetland

0 500 1,000 2,000 Feet

1:12,000 (At original document size of 11x17)

Stantec TVA

Project Location
Paducah
McCracken County, Kentucky

172675016
Prepared by WSW on 2015-07-09
Technical Review by AS on 2015-07-09
Independent Review by MS on 2015-07-09

Client/Project
Tennessee Valley Authority (TVA)
Shawnee Fossil Plant
New Landfill Siting Study

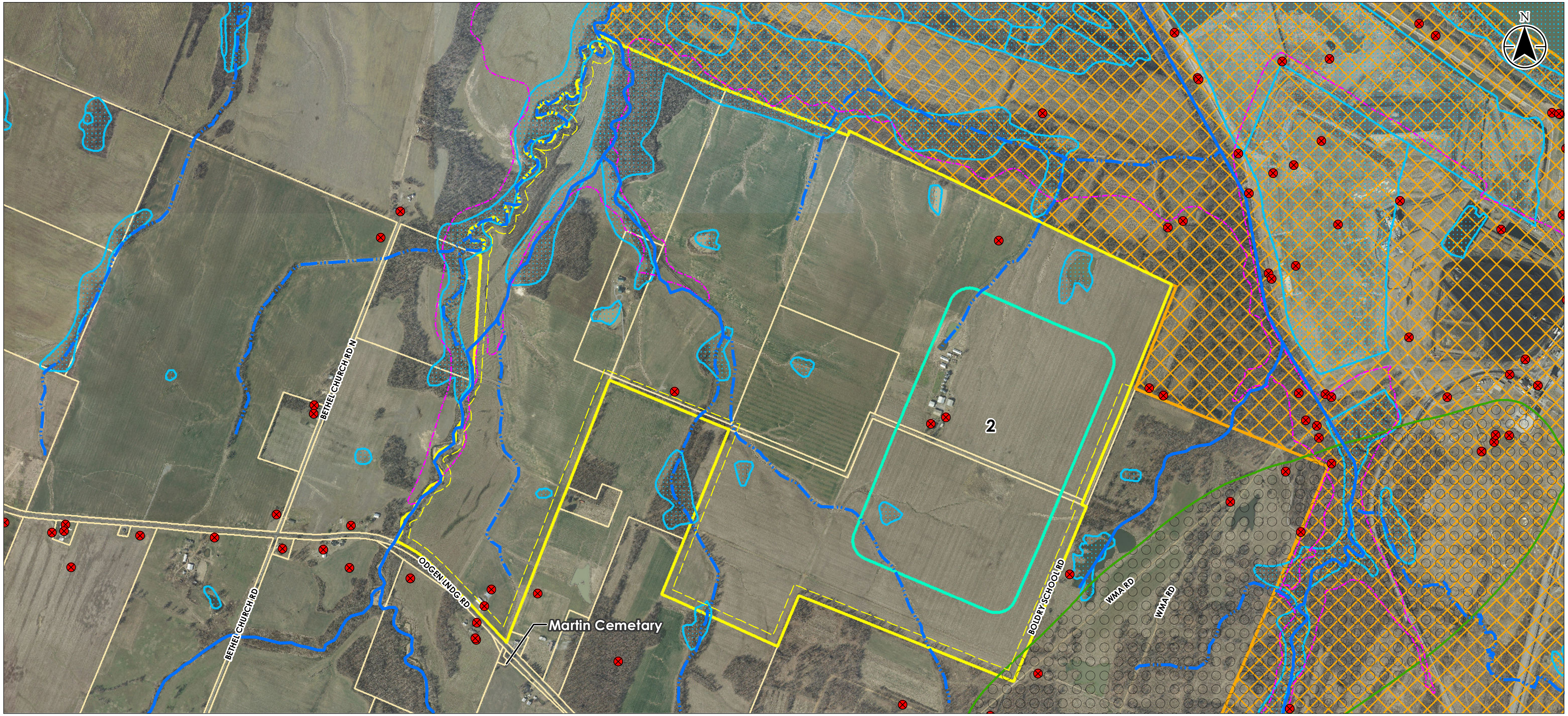
Figure No.
2

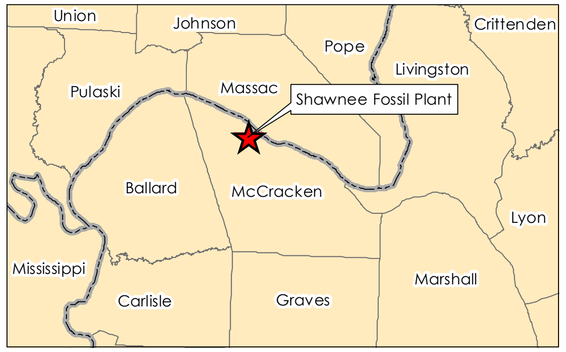
Title
Site Option 1 Map

Z:\172675016\MXDs\Fig2.mxd Revised: 2015-07-09 By: swheatley

Appendix E.2

Option 2 Site





Legend

- Water Well
- Stream (Intermittent)
- Stream (Perennial)
- 100-Year Floodplain
- Property Line Setback (100')
- Proposed Landfill Foot Print (140 Acre LF Foot Print)
- Site Boundary
- TVA Property
- 5-Mile Radius
- 10-Mile Radius
- Parcel
- Groundwater Plume
- NWI Wetland

0 600 1,200 2,400 Feet

1:14,400 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane Kentucky South FIPS 1602 Feet
2. Imagery Courtesy of KyFromAbove (KYAPED) (Dated 2013)

Stantec

TVA

Project Location
Paducah
McCracken County, Kentucky

172675016
Prepared by WSW on 2015-07-09
Technical Review by AS on 2015-07-09
Independent Review by MS on 2015-07-09

Client/Project
Tennessee Valley Authority (TVA)
Shawnee Fossil Plant
New Landfill Siting Study

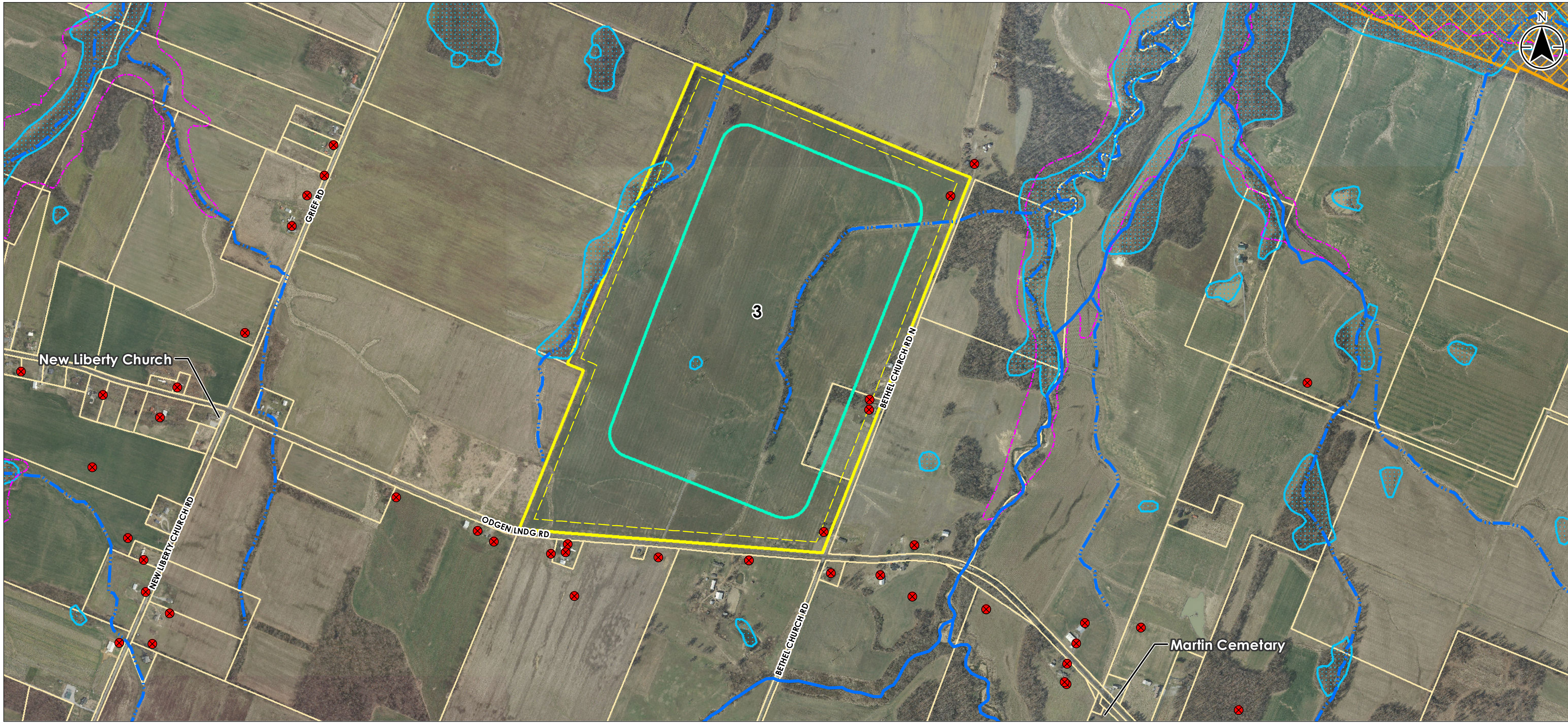
Figure No.
3

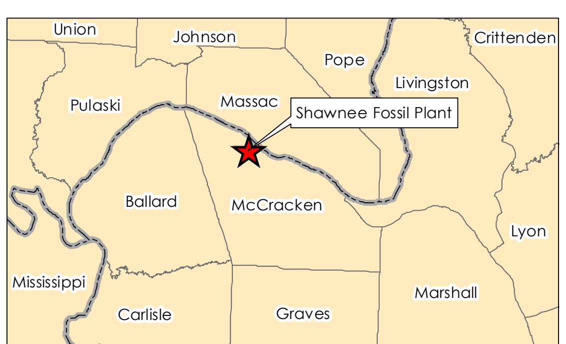
Title
Site Option 2 Map

Z:\172675016\MXDs\fig3.mxd Revised: 2015-07-09 By: swheatley

Appendix E.3

Option 3 Site





Legend

- Water Well
- Stream (Intermittent)
- Stream (Perennial)
- 100-Year Floodplain
- Property Line Setback (100')
- Proposed Landfill Foot Print (140 Acre LF Foot Print)
- Site Boundary
- TVA Property
- 5-Mile Radius
- 10-Mile Radius
- Parcel
- Groundwater Plume
- NWI Wetland

0 500 1,000 2,000 Feet

1:12,000 (At original document size of 11x17)

Stantec

TVA

Notes

1. Coordinate System: NAD 1983 StatePlane Kentucky South FIPS 1602 Feet
2. Imagery Courtesy of KyFromAbove (KYAPED) (Dated 2013)

Project Location
Paducah
McCracken County, Kentucky

172675016
Prepared by WSW on 2015-07-09
Technical Review by AS on 2015-07-09
Independent Review by MS on 2015-07-09

Client/Project
Tennessee Valley Authority (TVA)
Shawnee Fossil Plant
New Landfill Siting Study

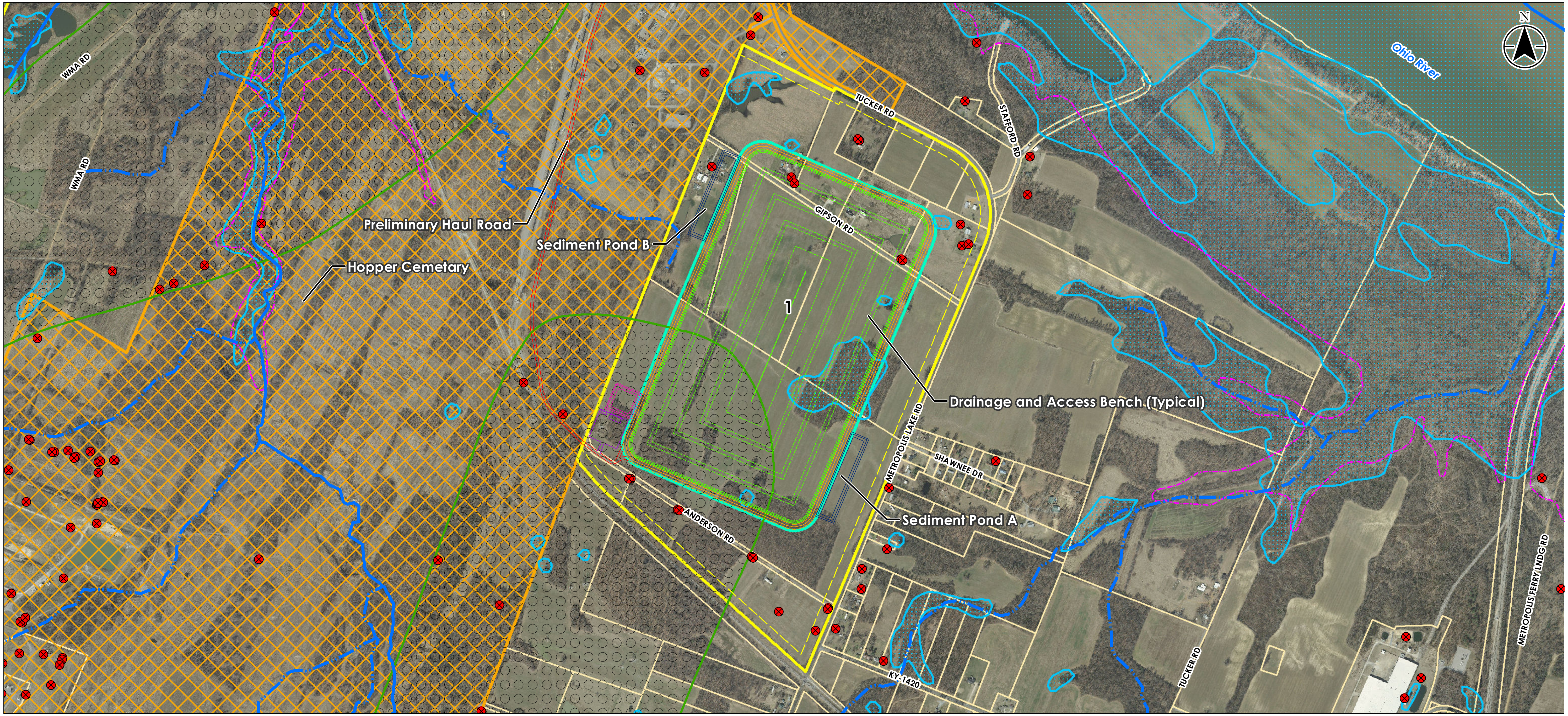
Figure No.
4

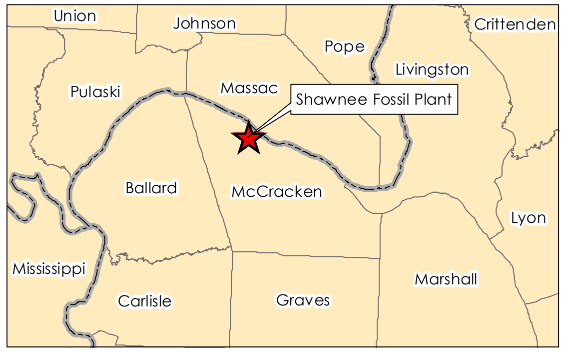
Title
Site Option 3 Map

Z:\172675016\MXDs\Fig4.mxd Revised: 2015-07-09 By: swheatley

Appendix F

Recommended Candidate Site





Legend

- Water Well
- Stream (Intermittent)
- Stream (Perennial)
- 100-Year Floodplain
- Property Line Setback (100')

CCR Landfill Site Features

- Ancillary Facility Area
- Crest
- Drainage and Access Bench (Typical)
- Leachate Storage Pond
- Preliminary Haul Road
- Sediment Pond

- Proposed Landfill Foot Print (140 Acre LF Foot Print)
- Site Boundary
- TVA Property
- 5-Mile Radius
- 10-Mile Radius
- Parcel
- Groundwater Plume
- NWI Wetland

0 500 1,000 2,000 Feet

1:12,000 (At original document size of 11x17)

Stantec TVA

Project Location
Paducah
McCracken County, Kentucky

172675016
Prepared by WSW on 2015-07-09
Technical Review by AS on 2015-07-09
Independent Review by MS on 2015-07-09

Client/Project
Tennessee Valley Authority (TVA)
Shawnee Fossil Plant
New Landfill Siting Study

Figure No.
5

Title
Alternative Candidate Site Location

Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky South FIPS 1602 Feet
2. Imagery Courtesy of KyFromAbove (KYAPED) (Dated 2013)

Z:\172675016\MXD\Fig5.mxd Revised: 2015-07-09 By: swheatley

Attachment B

Cost Opinions

SHF - New Landfill
Construction Cost Estimate

SHF - NEW LANDFILL					
Approximate Landfill Footprint (Acres)		140.0			
Storage Capacity (CY)		21,000,000			
CCR Disposal Rate (CY/YR)(Ave)		955,000			
Design Life (Years)		20.0			
Number of Construction Stages		4			
Total Fill (Liner) Footprint (Acres)		140			
Item Description		Quantity	Unit	Unit Price	Estimated Cost
Stage 1 - (Yr 0-5 Storage)					
	Cell Area	61.7	AC		
	Years of Operation	5	YR		
Land Acquisition	Not included in project	0	AC		$ -
Mobilization	Project Mobilization	1	LS	5% of total cost	$ 1,158,357
Site Preparation	Clearing & Grubbing-Heavy Woods	8.0	AC	$ 7,175	$ 57,617
	Strip Topsoil (6 inches)	64,777	CY	$ 4.00	$ 259,109
Sediment Control	Sediment Control Ponds (1 @ 4 acre)				
	Earthwork	20,000	CY	$ 5.00	$ 100,000
	Outlet Structure	1	EA	$ 15,000	$ 15,000
	General E & S Control	62	AC	$ 8,000	$ 496,000
	Perimeter Surface Ditches (Run-Off)	4,700	LF	$ 50	$ 235,000
	Excavation included in Subgrade prep below		CY		
	Grass-Lined Channels	10,084	LF	$ 20	$ 201,680
	Seeding and Mulching	62	AC	$ 3,000	$ 186,000
Access Road					
8,000 LF, 30' wide surface, 40' top width	Stripping of Topsoil	5,926	CY	$ 0.89	$ 5,274
	Soil Fill (assume at grade)	0	CY	$ 6.00	$ -
	Geotextile (35' width)	280,000	SF	$ 0.30	$ 84,000
	Crusher Run (30' width, 4" depth @ 1.5 Tons/CY)	4,444	TON	$ 30	$ 133,333
	No. 2 Stone (35' width, 12" depth @1.5 Tons/CY)	5,185	TON	$ 30	$ 155,556
	Seeding and Mulching	0.92	AC	$ 3,000	$ 2,755
Perimeter Road					
4800 LF, 40' wide surface, 50' top width	Soil Fill	120,000	CY	$ 6.00	$ 720,000
	Geotextile (45' width)	216,000	SF	$ 0.30	$ 64,800
	Crusher Run (40' width, 4" depth @ 1.5 Tons/CY)	3,556	TON	$ 30	$ 106,667
	No. 2 Stone (45' width, 12" depth @1.5 Tons/CY)	12,000	TON	$ 30	$ 360,000
	Seeding and Mulching	0.55	AC	$ 3,000	$ 1,653
Subgrade Preparation	Soil Excavation	1,080,000	CY	$ 3.00	$ 3,240,000
Liner & Leachate Collection Systems	Compacted Soil Liner: 24" of 1 x 10^{-5} Material	199,394	CY	$ 15	$ 2,990,911
	Geosynthetic Clay Liner (GCL)	2,691,820	SF	$ 0.55	$ 1,480,501
	60-mil HDPE Textured (FML)	2,691,820	SF	$ 0.80	$ 2,153,456
	Geotextile Cushion	2,691,820	SF	$ 0.30	$ 807,546
	Drainage Layer (12" of No. 57 Stone)	99,697	CY	$ 30	$ 2,990,911
	HDPE Drainage Header Piping, Geotextile and Stone	11,700	LF	$ 37	$ 432,900
	Separation Geotextile Fabric	2,691,820	SF	$ 0.30	$ 807,546
	Protective Cover: 12" of CCR	99,697	CY	$ 5	$ 498,485
Leachate/Contact Stormwater Conveyance	Pond (1 @ 1.5 acre)				
	Earthwork	25,000	CY	$ 5	$ 125,000
	Compacted Soil Liner: 24" of 1 x 10^{-5} Material	4,800	CY	$ 15	$ 72,000
	60-mil HDPE Textured (2 Layers) (FML)	130,000	SF	$ 0.8	$ 104,000
	Geocomposite Drainage Layer	65,000	SF	$ 0.85	$ 55,250
	Leak Collection Pipe	200	LF	$ 50	$ 10,000
	Leak Observation Point Manhole	2	EA	$ 5,000	$ 10,000
	Leachate Conveyance	1	LS	$ 500,000	$ 500,000
Stormwater Collection	Stormwater Inlet Headwall	8	EA	$ 3,500	$ 28,000
	Stormwater Junction Box	8	EA	$ 3,500	$ 28,000
	Perimeter Stormwater Collection Pipe	4,900	LF	$ 80	$ 392,000
Environmental Mitigation	Stream Mitigation	505	LF	$ 240	$ 121,200
	Wetlands Mitigation	13	AC	$ 29,000	$ 377,000
Monitoring Wells	Groundwater Monitoring Wells	6	EA	$ 5,000	$ 30,000
Ancillary Facilities	Building (Office Trailer)	1	EA	$ 25,000	$ 25,000
	Truck Wash	1	EA	$ 50,000	$ 50,000
	Fencing (site perimeter)	14,800	LF	$ 25	$ 370,000
	Gate	1	EA	$ 5,000	$ 5,000
	Power	1	EA	$ 50,000	$ 50,000
	Sanitary (Septic Tank/Field Lines)	1	EA	$ 8,000	$ 8,000
	Water (3" routed from Metropolis Lake Road)	2,000	LF	$ 20	$ 40,000

SHF - New Landfill
Construction Cost Estimate

SHF - NEW LANDFILL						
Approximate Landfill Footprint (Acres)		140.0				
Storage Capacity (CY)		21,000,000				
CCR Disposal Rate (CY/YR)(Ave)		955,000				
Design Life (Years)		20.0				
Number of Construction Stages		4				
Total Fill (Liner) Footprint (Acres)		140				
Item Description		**Quantity**	**Unit**	**Unit Price**	**Estimated Cost**	
Field Engineering/CQA	Post Construction Reporting	1	LS	$ 20,000	$ 20,000	
	Construction Management (Civil Lead/Saftey)	18	Mo	$ 50,000	$ 900,000	
	Construction Monitoring - Liner	18	Mo	$ 65,000	$ 1,170,000	
	Conformance Surveying - Liner	18	Mo	$ 5,000	$ 90,000	
Construction Contingency	30% of Construction Subtotal				$ 6,643,652	
TVA Costs and Contingencies	Construction Oversight (@ 10% of Construction Costs)	1	LS	$ 2,098,715	$ 2,098,715	
	Project Management (@ 5% of Construction Costs)	1	LS	$ 1,049,357	$ 1,049,357	
	Construction Risk Dollars (@ 10% of Construction Costs)	1	LS	$ 2,098,715	$ 2,098,715	
	Project Risk Dollars (@ 10% of Construction Costs)	1	LS	$ 2,098,715	$ 2,098,715	
		Subtotal - Landfill Construction			**$ 38,314,661**	
Operating Cost	CCR Load and Haul	4,775,000	CY	$ 4.66	$ 22,251,500	
	CCR Placement	4,775,000	CY	$ 2.46	$ 11,746,500	
	Intermediate Soil Cover (12")	100,000	CY	$ 3.00	$ 300,000	
	Downslope Drains (temp)	9	EA	$ 5,000	$ 45,000	
	Groundwater Monitoring	5	YR	$ 50,000	$ 250,000	
	Haul Road Maintenance	5	YR	$ 10,000	$ 50,000	
	Dust Control	5	YR	$ 10,000	$ 50,000	
	Mowing ($4/msf); 8 per year	5	YR	$ 86,336	$ 431,678	
	Ditch & Sediment Pond Maintenance	5	YR	$ 4,000	$ 20,000	
		Subtotal - Landfill Operating Costs			**$ 35,144,678**	

SHF - New Landfill
Construction Cost Estimate

SHF - NEW LANDFILL					
Approximate Landfill Footprint (Acres)		140.0			
Storage Capacity (CY)		21,000,000			
CCR Disposal Rate (CY/YR)(Ave)		955,000			
Design Life (Years)		20.0			
Number of Construction Stages		4			
Total Fill (Liner) Footprint (Acres)		140			
Item Description		**Quantity**	**Unit**	**Unit Price**	**Estimated Cost**
Stage 2 - (Yr 5-10 Storage)					
	Cell Area	25.9	AC		
	Years of Operation	5	YR		
Mobilization	Project Mobilization	1	LS	5% of total cost	$ 388,263
Site Preparation	Clearing & Grubbing-Heavy Woods	3.31	AC	$ 7,175	$ 23,724
	Strip Topsoil (6 inches)	26,672	CY	$ 4	$ 106,688
Sediment Control	Sediment Control Ponds (1 @ 4 acre)				
	Earthwork	20,000	CY	$ 5	$ 100,000
	Outlet Structure	1	EA	$ 15,000	$ 15,000
	General E & S Control	25.9	AC	$ 8,000	$ 206,957
	Perimeter Surface Ditches (Run-Off)	1200	LF	$ 50	$ 60,000
	Excavation included in Subgrade prep below		CY		
	Grass-Lined Channels	3600	LF	$ 20	$ 72,000
	Seeding and Mulching	25.9	AC	$ 3,000	$ 77,609
Perimeter Road					
1200 LF, 40' wide surface, 50' top width	Soil Fill	30,000	CY	$ 6	$ 180,000
	Geotextile (45' width)	54,000	SF	$ 0.3	$ 16,200
	Crusher Run (40' width, 4" depth @ 1.5 Tons/CY)	889	TON	$ 30	$ 26,667
	No. 2 Stone (45' width, 12" depth @1.5 Tons/CY)	3,000	TON	$ 30	$ 90,000
	Seeding and Mulching	1.10	AC	$ 3,000	$ 3,306
Subgrade Preparation	Soil Excavation	450,000	CY	$ 3	$ 1,350,000
Liner & Leachate Collection Systems	Compacted Soil Liner: 24" of 1 x 10-5 Material	83,473	CY	$ 15	$ 1,252,091
	Geosynthetic Clay Liner (GCL)	1,126,882	SF	$ 0.55	$ 619,785
	60-mil HDPE Textured (FML)	1,126,882	SF	$ 0.8	$ 901,506
	Geotextile Cushion	1,126,882	SF	$ 0.3	$ 338,065
	Drainage Layer (12" of No. 57 Stone)	41,736	CY	$ 30	$ 1,252,091
	HDPE Drainage Header Piping, Geotextile and Stone	5,860	LF	$ 37	$ 216,820
	Separation Geotextile Fabric	1,126,882	SF	$ 0.3	$ 338,065
	Protective Cover: 12" of CCR	41,736	CY	$ 5	$ 208,682
Leachate/Contact Stormwater Conveyance	Leachate Conveyance	1	LS	$ 200,000	$ 200,000
Stormwater Collection	Stormwater Inlet Headwall	2	EA	$ 3,500	$ 7,000
	Stormwater Junction Box	2	EA	$ 3,500	$ 7,000
	Perimeter Stormwater Collection Pipe	1,200.00	LF	$ 80	$ 96,000
Design/Permitting	Prep of Construction Docs (@5% of Construction Cost)	1.00	LS	$ 407,676	$ 407,676
Field Engineering/CQA	Post Construction Reporting	1	LS	$ 20,000	$ 20,000
	Construction Management (Civil Lead/Saftey)	5	Mo	$ 50,000	$ 250,000
	Construction Adm/Monitoring - Liner	5	Mo	$ 65,000	$ 325,000
	Conformance Surveying - Liner	5	Mo	$ 5,000	$ 25,000
Construction Contingency	30% of Construction Subtotal				$ 2,446,055
TVA Costs and Contingencies	Construction Oversight (@ 10% of Construction Costs)	1	LS	$ 815,352	$ 815,352
	Project Management (@ 5% of Construction Costs)	1	LS	$ 407,676	$ 407,676
	Construction Risk Dollars (@ 10% of Construction Costs)	1	LS	$ 815,352	$ 815,352
	Project Risk dollars (@ 10% of Construction Costs)	1	LS	$ 815,352	$ 815,352
		Subtotal - Landfill Construction			**$ 14,480,979**
Operating Cost	CCR Hauling	4,775,000	CY	$ 4.7	$ 22,251,500
	CCR Placement	4,775,000	CY	$ 2.5	$ 11,746,500
	Intermediate Soil Cover (12")	42,000	CY	$ 3	$ 126,000
	Downslope Drains (temp)	9	EA	$ 5,000	$ 45,000
	Leachate Monitoring	5	YR	$ 50,000	$ 250,000
	Haul Road Maintenance	5	YR	$ 10,000	$ 50,000
	Dust Control	5	YR	$ 10,000	$ 50,000
	Mowing	5	YR	$ 122,553	$ 612,765
	Ditch & Sediment Pond Maintenance	5	YR	$ 4,000	$ 20,000
		Subtotal - Landfill Operating Costs			**$ 35,151,765**

SHF - New Landfill
Construction Cost Estimate

SHF - NEW LANDFILL	
Approximate Landfill Footprint (Acres)	140.0
Storage Capacity (CY)	21,000,000
CCR Disposal Rate (CY/YR)(Ave)	955,000
Design Life (Years)	20.0
Number of Construction Stages	4
Total Fill (Liner) Footprint (Acres)	140

Item Description		Quantity	Unit	Unit Price	Estimated Cost
Stage 3 - (Yr 10-15 Storage)					
	Cell Area	25.9	AC		
	Years of Operation	5	YR		
Mobilization	Project Mobilization	1	LS	5% of total cost	$ 382,062
Site Preparation	Clearing & Grubbing-Heavy Woods	2.9	AC	$ 7,175	$ 20,872
	Strip Topsoil (6 inches)	23,466	CY	$ 4.00	$ 93,864
Sediment Control	General E & S Control	25.9	AC	$ 8,000	$ 207,279
	Perimeter Surface Ditches (Run-Off)	1200	LF	$ 50	$ 60,000
	Excavation included in Subgrade prep below		CY		
	Grass-Lined Channels	3600	LF	$ 20	$ 72,000
	Seeding and Mulching	26	AC	$ 3,000	$ 77,730
Perimeter Road					
1200 LF, 40' wide surface, 50' top width	Soil Fill	30,000	CY	$ 6	$ 180,000
	Geotextile (45' width)	54,000	SF	$ 0.3	$ 16,200
	Crusher Run (40' width, 4" depth @ 1.5 Tons/CY)	889	TON	$ 30	$ 26,667
	No. 2 Stone (45' width, 12" depth @1.5 Tons/CY)	3,000	TON	$ 30	$ 90,000
	Seeding and Mulching	0.14	AC	$ 3,000	$ 413
Subgrade Preparation	Soil Excavation	450,000	CY	$ 3	$ 1,350,000
Liner & Leachate Collection Systems	Compacted Soil Liner: 24" of 1 x 10-5 Material	83,603	CY	$ 15	$ 1,254,039
	Geosynthetic Clay Liner (GCL)	1,128,635	SF	$ 0.55	$ 620,749
	60-mil HDPE Textured (FML)	1,128,635	SF	$ 0.8	$ 902,908
	Geotextile Cushion	1,128,635	SF	$ 0.3	$ 338,591
	Drainage Layer (12" of No. 57 Stone)	41,801	CY	$ 30	$ 1,254,039
	HDPE Drainage Header Piping, Geotextile and Stone	5,900	LF	$ 37	$ 218,300
	Separation Geotextile Fabric	1,128,635	SF	$ 0.3	$ 338,591
	Protective Cover: 12" of CCR	41,801	CY	$ 5	$ 209,006
Leachate/Contact Stormwater Conveyance	Leachate Conveyance	1	LS	$ 200,000	$ 200,000
Stormwater Collection	Stormwater Inlet Headwall	2	EA	$ 3,500	$ 7,000
	Stormwater Junction Box	2	EA	$ 3,500	$ 7,000
	Perimeter Stormwater Collection Pipe	1,200	LF	$ 80	$ 96,000
Design/Permitting	Prep of Construction Docs (@5% of Construction Cost)	1.00	LS	$ 382,062	$ 382,062
Field Engineering/CQA	Post Construction Reporting	1	LS	$ 20,000	$ 20,000
	Construction Management (Civil Lead/Saftey)	5	Mo	$ 50,000	$ 250,000
	Construction Adm/Monitoring - Liner	5	Mo	$ 65,000	$ 325,000
	Conformance Surveying - Liner	5	Mo	$ 5,000	$ 25,000
Construction Contingency	30% of Construction Subtotal				$ 2,406,993
TVA Costs and Contingencies	Construction Oversight (@ 10% of Construction Costs)	1	LS	$ 802,331	$ 802,331
	Project Management (@ 5% of Construction Costs)	1	LS	$ 401,165	$ 401,165
	Construction Risk Dollars (@ 10% of Construction Costs)	1	LS	$ 802,331	$ 802,331
	Project Risk dollars (@ 10% of Construction Costs)	1	LS	$ 802,331	$ 802,331
		Subtotal - Landfill Construction			**$ 14,240,523**
Operating Cost	CCR Hauling	4,775,000	CY	$ 4.7	$ 22,251,500
	CCR Placement	4,775,000	CY	$ 2.5	$ 11,746,500
	Intermediate Soil Cover (12")	42,000	CY	$ 3	$ 126,000
	Downslope Drains (temp)	9	EA	$ 5,000	$ 45,000
	Leachate Monitoring	5	YR	$ 50,000	$ 250,000
	Haul Road Maintenance	5	YR	$ 10,000	$ 50,000
	Dust Control	5	YR	$ 10,000	$ 50,000
	Mowing	5	YR	$ 158,827	$ 794,135
	Ditch & Sediment Pond Maintenance	5	YR	$ 4,000	$ 20,000
		Subtotal - Landfill Operating Costs			**$ 35,333,135**

SHF - New Landfill
Construction Cost Estimate

SHF - NEW LANDFILL	
Approximate Landfill Footprint (Acres)	140.0
Storage Capacity (CY)	21,000,000
CCR Disposal Rate (CY/YR)(Ave)	955,000
Design Life (Years)	20.0
Number of Construction Stages	4
Total Fill (Liner) Footprint (Acres)	140

Item Description		Quantity	Unit	Unit Price	Estimated Cost
Stage 4 - (Yr 15-20 Storage)					
	Cell Area	27.2	AC		
	Years of Operation	5	YR		
Mobilization	Project Mobilization	1	LS	5% of total cost	$ 536,197
Site Preparation	Clearing & Grubbing-Heavy Woods	3.5	AC	$ 7,175	$ 24,961
	Strip Topsoil (6 inches)	28,063	CY	$ 4	$ 112,253
Sediment Control	General E & S Control	27.2	AC	$ 8,000	$ 217,952
	Perimeter Surface Ditches (Run-Off)	3,200	LF	$ 50	$ 160,000
	Excavation included in Subgrade prep below		CY		
	Grass-Lined Channels	5280	LF	$ 20	$ 105,600
	Seeding and Mulching	27.2	AC	$ 3,000	$ 81,732
Perimeter Road					
3200 LF, 40' wide surface, 50' top width	Soil Fill	80,000	CY	$ 6	$ 480,000
	Geotextile (45' width)	144000.00	SF	$ 0.3	$ 43,200
	Crusher Run (40' width, 4" depth @ 1.5 Tons/CY)	2370	TON	$ 30	$ 71,111
	No. 2 Stone (45' width, 12" depth @1.5 Tons/CY)	8000	TON	$ 30	$ 240,000
	Seeding and Mulching	0.37	AC	$ 3,000	$ 1,102
Subgrade Preparation					
	Soil Excavation	475,000	CY	$ 3	$ 1,425,000
Liner & Leachate Collection Systems					
	Compacted Soil Liner: 24" of 1 x 10-5 Material	87,907	CY	$ 15	$ 1,318,611
	Geosynthetic Clay Liner (GCL)	1,186,750	SF	$ 0.55	$ 652,713
	60-mil HDPE Textured (FML)	1,186,750	SF	$ 0.8	$ 949,400
	Geotextile Cushion	1,186,750	SF	$ 0.3	$ 356,025
	Drainage Layer (12" of No. 57 Stone)	43,954	CY	$ 30	$ 1,318,611
	HDPE Drainage Header Piping, Geotextile and Stone	5,900	LF	$ 37	$ 218,300
	Separation Geotextile Fabric	1,186,750	SF	$ 0	$ 356,025
	Protective Cover: 12" of CCR	43,954	CY	$ 5	$ 219,769
Leachate/Contact Stormwater Conveyance					
	Leachate Conveyance	1	LS	$ 400,000	$ 400,000
Stormwater Collection					
	Stormwater Inlet Headwall	5	EA	$ 3,500	$ 17,500
	Stormwater Junction Box	5	EA	$ 3,500	$ 17,500
	Perimeter Stormwater Collection Pipe	3,300	LF	$ 80	$ 264,000
Design/Permitting	Prep of Construction Docs (@5% of Construction Cost)	1.00	LS	$ 452,568	$ 452,568
Field Engineering/CQA					
	Post Construction Reporting	1	LS	$ 20,000	$ 20,000
	Construction Management (Civil Lead/Saftey)	10	Mo	$ 50,000	$ 500,000
	Construction Adm/Monitoring - Liner	10	Mo	$ 65,000	$ 650,000
	Conformance Surveying - Liner	10	Mo	$ 5,000	$ 50,000
Construction Contingency	30% of Construction Subtotal				$ 2,876,269
TVA Costs and Contingencies					
	Construction Oversight (@ 10% of Construction Costs)	1	LS	$ 958,756	$ 958,756
	Project Management (@ 5% of Construction Costs)	1	LS	$ 479,378	$ 479,378
	Construction Risk Dollars (@ 10% of Construction Costs)	1	LS	$ 958,756	$ 958,756
	Project Risk dollars (@ 10% of Construction Costs)	1	LS	$ 958,756	$ 958,756
		Subtotal - Landfill Construction			**$ 17,492,046**
Operating Cost					
	CCR Hauling	4,775,000	CY	$ 4.7	$ 22,251,500
	CCR Placement	4,775,000	CY	$ 2.5	$ 11,746,500
	Intermediate Soil Cover (12")	44,000	CY	$ 3	$ 132,000
	Downslope Drains (temp)	9	EA	$ 5,000	$ 45,000
	Leachate Monitoring	5	YR	$ 50,000	$ 250,000
	Haul Road Maintenance	5	YR	$ 10,000	$ 50,000
	Dust Control	5	YR	$ 10,000	$ 50,000
	Mowing	5	YR	$ 196,969	$ 984,843
	Ditch & Sediment Pond Maintenance	5	YR	$ 4,000	$ 20,000
		Subtotal - Landfill Operating Costs			**$ 35,529,843**

SHF - New Landfill
Construction Cost Estimate

SHF - NEW LANDFILL					
Approximate Landfill Footprint (Acres)		140.0			
Storage Capacity (CY)		21,000,000			
CCR Disposal Rate (CY/YR)(Ave)		955,000			
Design Life (Years)		20.0			
Number of Construction Stages		4			
Total Fill (Liner) Footprint (Acres)		140			
Item Description		**Quantity**	**Unit**	**Unit Price**	**Estimated Cost**
Closure					
	Closure Area	140	AC		
Mobilization	Project Mobilization	1	LS	2.5% of total cost	$ 405,746
Sediment Control	General E & S Control	141	AC	$ 8,000	$ 1,128,189
	Perimeter Surface Ditches (Run-Off)	10,300	LF	$ 50	$ 515,000
	Excavation included in Subgrade prep below		CY		
	Rip-Rap Drainage Flumes (Channels >8%)	7,092	LF	$ 60	$ 425,520
	Grass-Lined Channels	22,564	LF	$ 20	$ 451,280
Cap					
144 Acres	Landfill Cap: 6" Vegetative Cover	116,167	CY	$ 9	$ 1,045,500
	Landfill Cap: 18" Protective Cover	348,500	CY	$ 9	$ 3,136,500
	Geocomposite Drainage Layer	6,273,000	SF	$ 0.85	$ 5,332,050
	40-mil LLDPE Textured (FML)	6,273,000	SF	$ 0.6	$ 3,763,800
	Seeding and Mulching	144	AC	$ 3,000	$ 432,000
Design/Permitting	Prep of Construction Docs (@5% of Construction Cost)	1.00	LS	$ 831,779	$ 831,779
Field Engineering/CQA					
	Construction Adm/Monitoring - Cap	18	Mo	$ 65,000	$ 1,170,000
	Conformance Surveying - Cap	18	Mo	$ 5,000	$ 90,000
	Post Construction Reporting	1	LS	$ 20,000	$ 20,000
	Construction Management (Civil Lead/Safety)	18	Mo	$ 50,000	$ 900,000
Construction Contingency	30% of Construction Subtotal				$ 4,990,675
TVA Costs and Contingencies					
	Construction Oversight (@ 10% of Construction Costs)	1	LS	$ 1,663,558	$ 1,663,558
	Project Management (@ 5% of Construction Costs)	1	LS	$ 811,492	$ 811,492
	Construction Risk Dollars (@ 10% of Construction Costs)	1	LS	$ 1,706,162	$ 1,706,162
	Project Risk dollars (@ 10% of Construction Costs)	1	LS	$ 1,823,162	$ 1,823,162
		Subtotal - Closure Construction			**$ 30,642,413**
				Construction Total	**$ 115,170,622**
				Operating Total	**$ 141,159,421**
Assumptions					
	Cost does not include land acquisition				
	Cuts/fills can be balanced during final design				
	Blue line streams are as indicated on USGS map				
	Entire site fenced in Phase 1				

Estimated Capital and O&M Cost Summary for Stage 1

Activity	Total	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39	FY40	FY41	FY42	FY43	Total 2015 Dollars	Total Escalated Dollars
Phase 1																																
Siting Study	$ 70,000	$ 70,000																													$ 70,000	$ 70,000
Conceptual Design	$ 20,000	$ 20,000																													$ 20,000	$ 20,000
Project Workshops	$ 70,000	$ 70,000																													$ 70,000	$ 70,000
Phase 2 and 3 Planning (PPD)	$ 30,000	$ 30,000																													$ 30,000	$ 30,000
Project Administration, Design Meetings and Management	$ 70,000	$ 70,000																													$ 70,000	$ 70,000
Phase 2																																
NEPA Coordination with TVA	$ 50,000		$ 25,000	$ 25,000																											$ 50,000	$ 52,273
TVA NEPA Evaluation			$ -																												$ -	$ -
Final Geotech and Hydrogeo Expl and Lab Testing	$ 350,000		$ 350,000																												$ 350,000	$ 360,500
State Solid Waste Permit Process/Permit Drawings	$ 55,000		$ 38,500	$ 11,000	$ 5,500																										$ 55,000	$ 57,335
Design and Permitting of Ancillary Facilites	$ 30,000				$ 30,000	$ 30,000																									$ 60,000	$ 66,547
Other Permitting	$ 46,000			$ 46,000																											$ 46,000	$ 48,801
Final Construction Documents	$ 250,000					$ 250,000																									$ 250,000	$ 281,377
Contractor Bidding Support	$ 45,000					$ 45,000																									$ 45,000	$ 50,648
Project Administration, Design Meetings and Management	$ 400,000		$ 100,000	$ 100,000	$ 100,000	$ 100,000																									$ 400,000	$ 430,914
TVA Project Management/Engineering/Construction Management			$ -	$ -	$ -																										$ -	$ -
Phase 2 Risk Analysis																																
Estimated Phase 2 Monte Carlo Risk Costs						$ -																									$ -	$ -
Phase 3 - Stage 1 Implementation (First Cell Construction)																																
Cell Construction (Stage 1)	$ 28,789,159						$ 14,394,579	$ 14,394,579																							$ 28,789,159	$ 33,875,143
Construction Monitoring CQA (Stage 1)	$ 1,170,000						$ 585,000	$ 585,000																							$ 1,170,000	$ 1,376,696
Conformance Surveying and CQA Report (Stage 1)	$ 110,000						$ 55,000	$ 55,000																							$ 110,000	$ 129,433
Stantec Project Administration	$ 900,000						$ 450,000	$ 450,000																							$ 900,000	$ 1,058,997
TVA Construction Oversight	$ 2,098,715						$ 1,049,357	$ 1,049,357																							$ 2,098,715	$ 2,469,481
TVA Project Management	$ 1,049,357						$ 524,679	$ 524,679																							$ 1,049,357	$ 1,234,740
TVA Construction Risk Dollars	$ 2,098,715						$ 1,049,357	$ 1,049,357																							$ 2,098,715	$ 2,469,481
TVA Project Risk Dollars	$ 2,098,715						$ 1,049,357	$ 1,049,357																							$ 2,098,715	$ 2,469,481
Phase 3 Risk Analysis																																
Estimated Phase 3 Monte Carlo Risk Costs							$ -	$ -																							$ -	$ -
Annual Costs - 2015 Dollars	$ 39,800,661	$ 260,000	$ 513,500	$ 182,000	$ 135,500	$ 425,000	$ 19,157,331	$ 19,157,331																							**Stage 1 Capital Costs (2015 Dollars) =**	**$ 39,830,661**
Annual Costs - Expenditure Year Dollars at 3%/yr Escalation		$ 260,000	$ 528,905	$ 193,084	$ 148,065	$ 478,341	$ 22,208,597	$ 22,874,855																							**Stage 1 Capital Costs (Expenditure Year) =**	**$ 46,691,846**

Estimated Capital and O&M Cost Summary for Future Stages

Activity	Total	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39				FY40	Total 2015 Dollars	Total Escalated Dollars
Stage 1 Operation and Maintenance																																
Stage 1 Operations and Maintenance Cost	$ 35,144,678								$ 7,028,936	$ 7,028,936	$ 7,028,936	$ 7,028,936	$ 7,028,936																		$ 35,144,678	$ 45,895,908
Stage 2 Expansion																																
Design/Permitting (Stage 2)	$ 407,676										$ 407,676																				$ 407,676	$ 531,925
Cell Construction (Stage 2)	$ 10,599,572											$ 5,299,786	$ 5,299,786																		$ 10,599,572	$ 14,458,613
Construction Monitoring CQA (Stage 2)	$ 325,000											$ 162,500	$ 162,500																		$ 325,000	$ 443,324
Conformance Surveying and CQA Report (Stage 2)	$ 45,000											$ 22,500	$ 22,500																		$ 45,000	$ 61,383
Stantec Project Administration	$ 250,000											$ 125,000	$ 125,000																		$ 250,000	$ 341,019
TVA Construction Oversight	$ 815,352											$ 407,676	$ 407,676																		$ 815,352	$ 1,112,201
TVA Project Management	$ 407,676											$ 203,838	$ 203,838																		$ 407,676	$ 556,100
TVA Construction Risk Dollars	$ 815,352											$ 407,676	$ 407,676																		$ 815,352	$ 1,112,201
TVA Project Risk Dollars	$ 815,352											$ 407,676	$ 407,676																		$ 815,352	$ 1,112,201
Stage 2 Operation and Maintenance																																
Stage 2 Operations and Maintenance Cost	$ 35,151,765													$ 7,030,353	$ 7,030,353	$ 7,030,353	$ 7,030,353	$ 7,030,353													$ 35,151,765	$ 53,216,667
Stage 2 Risk Analysis																																
Estimated Stage 2 Monte Carlo Risks												$ -																			$ -	$ -
Stage 3 Expansion																																
Design/Permitting (Stage 3)	$ 382,062															$ 382,062															$ 382,062	$ 577,903.61
Cell Construction (Stage 3)	$ 10,430,303																$ 5,215,151	$ 5,215,151													$ 10,430,303	$ 16,493,822.59
Construction Monitoring CQA (Stage 3)	$ 325,000																$ 162,500	$ 162,500													$ 325,000	$ 513,934.50
Conformance Surveying and CQA Report (Stage 3)	$ 45,000																$ 22,500	$ 22,500													$ 45,000	$ 71,160.16
Stantec Project Administration	$ 250,000																$ 125,000	$ 125,000													$ 250,000	$ 395,334.23
TVA Construction Oversight	$ 802,331																$ 401,165	$ 401,165													$ 802,331	$ 1,268,755.58
TVA Project Management	$ 401,165																$ 200,583	$ 200,583													$ 401,165	$ 634,377.79
TVA Construction Risk Dollars	$ 802,331																$ 401,165	$ 401,165													$ 802,331	$ 1,268,755.58
TVA Project Risk Dollars	$ 802,331																$ 401,165	$ 401,165													$ 802,331	$ 1,268,755.58
Stage 3 Operation and Maintenance																	$ -	$ -													$ -	$ -
Stage 3 Operations and Maintenance Cost	$ 35,333,135																		$ 7,066,627	$ 7,066,627	$ 7,066,627	$ 7,066,627	$ 7,066,627								$ 35,333,135	$ 62,011,012
Stage 3 Risk Analysis																																
Estimated Stage 3 Monte Carlo Risks																	$ -														$ -	$ -

Activity	Total	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39	FY40	FY41	FY42	FY43	Total 2015 Dollars	Total Escalated Dollars
Stage 4 Expansion																																
Design/Permitting (Stage 4)	$ 452,568																				$ 452,568										$ 452,568	$ 793,581.19
Cell Construction (Stage 4)	$ 12,463,831																					$ 6,231,915	$ 6,231,915								$ 12,463,831	$ 22,848,730.38
Construction Monitoring CQA (Stage 4)	$ 650,000																					$ 325,000	$ 325,000								$ 650,000	$ 1,191,581.89
Conformance Surveying and CQA Report (Stage 4)	$ 70,000																					$ 35,000	$ 35,000								$ 70,000	$ 128,324.20
Stantec Project Administration	$ 500,000																					$ 250,000	$ 250,000								$ 500,000	$ 916,601.45
TVA Construction Oversight	$ 958,756																					$ 479,378	$ 479,378								$ 958,756	$ 1,757,594.64
TVA Project Management	$ 479,378																					$ 239,689	$ 239,689								$ 479,378	$ 878,797.32
TVA Construction Risk Dollars	$ 958,756																					$ 479,378	$ 479,378								$ 958,756	$ 1,757,594.64
TVA Project Risk Dollars	$ 958,756																					$ 479,378	$ 479,378								$ 958,756	$ 1,757,594.64
Stage 3 Operation and Maintenance																																
Stage 4 Operations and Maintenance Cost	$ 35,529,843																							$ 7,105,969	$ 7,105,969	$ 7,105,969	$ 7,105,969	$ 7,105,969			$ 35,529,843	$ 42,084,985
Stage 4 Risk Analysis																																
Estimated Stage 4 Monte Carlo Risks																						$ -									$ -	$ -
Site Closure																																
Design/Permitting (Closure)	$ 831,779																											$ 831,779			$ 831,779	$ 1,793,807.82
Closure Construction	$ 21,626,260																												$ 10,813,130	$ 10,813,130	$ 21,626,260	$ 48,758,746.07
Construction Monitoring CQA Closure)	$ 1,170,000																												$ 585,000	$ 585,000	$ 1,170,000	$ 2,637,891.76
Conformance Surveying and CQA Report (Closure)	$ 110,000																												$ 55,000	$ 55,000	$ 110,000	$ 248,006.92
Stantec Project Administration	$ 900,000																												$ 450,000	$ 450,000	$ 900,000	$ 2,029,147.51
TVA Construction Oversight	$ 1,663,558																												$ 831,779	$ 831,779	$ 1,663,558	$ 3,750,672.77
TVA Project Management	$ 811,492																												$ 405,746	$ 405,746	$ 811,492	$ 1,829,596.48
TVA Construction Risk Dollars	$ 1,706,162																												$ 853,081	$ 853,081	$ 1,706,162	$ 3,846,726.59
TVA Project Risk Dollars	$ 1,823,162																												$ 911,581	$ 911,581	$ 1,823,162	$ 4,110,515.77
Closure Risk Analysis																																
Estimated Closure Monte Carlo Risks																													$ -		$ -	$ -
																														Stage 2-4 plus Closure Capital Only	$ 76,473,899	$ 143,257,279
																														Stage 2-4 plus Closure Capital + O&M	$ 218,017,397	$ 346,465,852
Annual Costs - 2015 Dollars:								$ -	$ 7,028,936	$ 7,028,936	$ 7,436,611	$ 14,065,587	$ 14,065,587	$ 7,030,353	$ 7,030,353	$ 7,412,415	$ 13,959,584	$ 13,959,584	$ 7,066,627	$ 7,066,627	$ 7,519,195	$ 15,586,366	$ 15,586,366	$ 7,105,969	$ 7,105,969	$ 7,105,969	$ 7,105,969	$ 7,937,748	$ 14,905,317	$ 14,905,317		
Annual Costs - Expenditure Year Dollars at 3%/yr Escalation:								$ -	$ 8,644,704	$ 8,904,045	$ 9,703,091	$ 18,902,973	$ 19,470,062	$ 10,023,602	$ 10,324,311	$ 11,211,943	$ 21,748,576	$ 22,401,034	$ 11,680,058	$ 12,030,459	$ 13,184,954	$ 28,150,710	$ 28,995,231	$ 13,615,771	$ 14,024,244	$ 14,444,971	$ 14,878,320	$ 17,118,478	$ 33,109,017	$ 34,102,287		

i 3%

Overall Facility Capital Total (2015 Dollars) =	**$ 116,304,560**
Overall Facility Capital Total (Expenditure Year) =	**$ 189,949,125**

Overall Facility O&M Total (2015 Dollars) =	**$ 141,159,421**
Overall Facility O&M Total (Expenditure Year) =	**$ 203,208,573**

Appendix H – Technical Water Memorandum

TVA Project Technical Water Memorandum

Project Name:	**Shawnee CCR Impoundment Closure EIS**
Project Number:	
Date:	**October 17, 2017**
To:	**Ashley Pilakowski**
Subject:	NEPA Surface Water
Prepared by:	A.C. Williams

1.0 Introduction/Project Description

TVA is proposing to change the way that coal combustion residuals (CCR) are managed at the Shawnee Fossil Plant (SHF) located in McCracken County, Kentucky. CCRs are byproducts produced from burning coal and include fly ash, bottom ash, hydrated lime and in the future flue gas desulfurization materials. Currently, CCR generated by the operating units at SHF are managed by sluicing to the existing Ash Impoundment 2 or handled pneumatically (dry) and stored on-site in the former SWL. Therefore, TVA has proposed the following projects at SHF:

- construct and operate a new special waste landfill
- closure of the Special Waste Landfill
- closure of the Ash Impoundment 2

On April 17, 2015, the EPA established national criteria and schedules for the management and closure of CCR facilities (80 Federal Register 21302) (herein referred to as the CCR Rule).

This Surface Water Technical Memorandum is in support of the preparation of an Environmental Impact Statement (EIS) pursuant to the National Environmental Policy Act (NEPA), to analyze the potential environmental impacts associated with the implementation of these new CCR management operations at SHF.

2.0 Methods & Assumptions

2.1 Methods

Surface water NEPA evaluations follow the NEPA methodology of: (a) describing and assessing the existing environment, (b) evaluating the potential changes which could occur from the proposed actions or projects, and (c) estimating the potential impacts those changes could have on the existing environment.

For surface water quality this process normally consists of first describing the existing surface waters adjacent to the proposed actions/projects including any existing wastewater streams that currently discharge into those surface waters. The second step is to estimate any new or changed wastewater streams that could result from the proposed actions and compare them to any existing wastewater streams. The third and final step is to evaluate the proposed changes and discuss the potential impacts that those changes could have on surface water quality.

Figure 1 – SHF Proposed Actions

2.2 Assumptions

- Both Bottom Ash Dewatering and the installation of FGDs and SCRs on Units 1 and 4 are pending project that have had NEPA assessments in the past. The FGD and SCR installation is currently in progress and is slated to be completed by the end of CY 2017.
- This NEPA review of CCR impoundment closures and new dewatering facilities at SHF is based on and tiers off the Final Ash Impoundment Closure Environmental Impact Statement, Part 1 - Programmatic NEPA Review, prepared by TVA in June 2016. It is available at the following website: https://www.tva.gov/Environment/Environmental-Stewardship/Environmental-Reviews/Closure-of-Coal-Combustion-Residual-Impoundments.
- Current operations at SHF are in compliance with all applicable regulations and permits.
- In general, a balanced indigenous aquatic population exists in the Ohio River adjacent to SHF concurrent with existing plant operations and wastewater discharges to surface waters. Therefore, current operations do not appear to have had major negative impacts on surface water quality.

2.3 Governing Regulations

- Federal Clean Water Act (40 CFR 401 and 401)
- Federal Safe Drinking Water Act (40 CFR 141-143)
- Kentucky KPDES Regulations – 401 KAR Chapter 5 (http://water.ky.gov/Pages/KPDESDWRegs.aspx)
- Kentucky Drinking Water Regulations – 401 KAR Chapter 8 (http://water.ky.gov/Pages/KPDESDWRegs.aspx)

3.0 Affected Environment - Surface Water

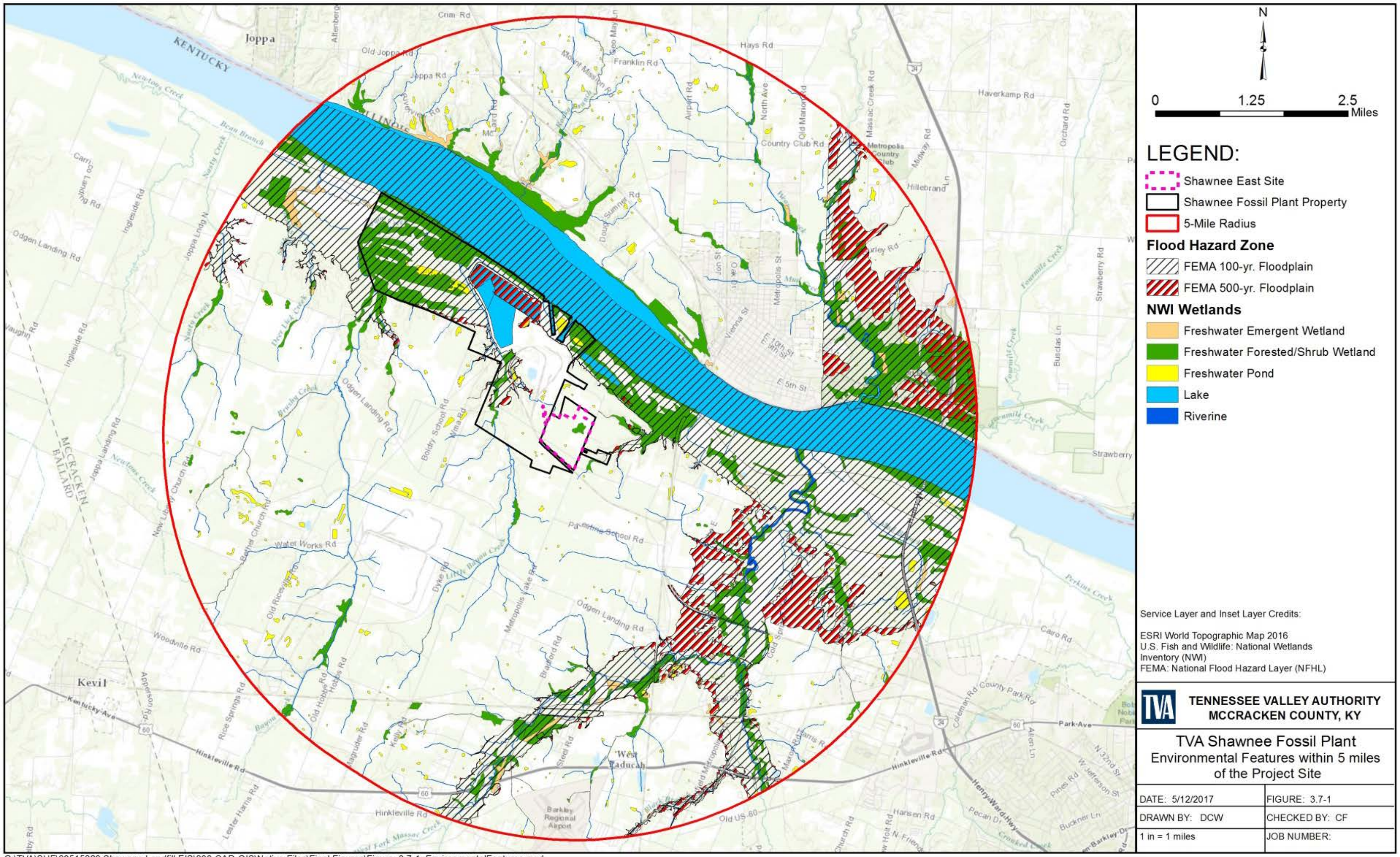
3.1 Surface Water - Ohio River

Surface Water

Affected Environment

The SHF site is located on the Ohio River, 35 mi upstream of its confluence with the Mississippi River (Ohio River Mile [ORM] 946). The plant is bordered by the Ohio River and Little Bayou Creek, which are both classified as warm water aquatic habitat (Figure 2). The 7Q10 flow (lowest stream flow for seven consecutive days that would be expected to occur once in 10 years) at the SHF discharge points on the Ohio River is 46,300 cubic feet per second (cfs), and on the Little Bayou Creek is 0 cfs (KDEP 2005).

The TVA SHF facility discharge is located between Lock and Dam 52 at Ohio River Mile (ORM) 938.9 and Lock and Dam 53 at ORM 962.6. These two locks and dams are under the control of and are operated by the United States Army Corps of Engineers (USACE), and are being replaced by the Olmstead Locks and Dam at ORM 964.4. Work on the new Olmstead locks is complete and work on the new dam is ongoing. Olmstead Dam does not currently provide any regulation of the river and in recent years there have been large swings in river elevations (USACE 2014). The average monthly stream flow



G:\TVA\SHF\60515229 Shawnee Landfill EIS\900-CAD-GIS\Native Files\Final Figures\Figure_3.7-1_EnvironmentalFeatures.mxd

Figure 2. Environmental Features within 5 Miles of the Project Site

is approximately 267,700 cfs. Generally, the Ohio River average depth is 24 ft and at its widest point is 1 mi across at Smithland Dam, about 27 mi upstream of SHF (ORSANCO 2014).

The reach of the Ohio River bordering Kentucky supports aquatic life and drinking water use. Primary contact recreation (water bodies suitable for full immersion swimming) is impaired for nearly 350 stream miles, or about 53 percent of the river in Kentucky. The pollutant causing this impairment is the pathogen indicator, *E. coli*. No reaches of the Ohio River fully support all assessed uses. This limitation is often a result of combined sewer overflows during and immediately following rainfall events along the riverfront and downstream of urban areas. The Kentucky reach of the Ohio River only partially supports fish consumption because of polychlorinated biphenyls (PCBs) and dioxin, while methylmercury residue in fish tissue is a cause of impairment in many of the river miles. The river reach from ORM 981.3 - 938.9, which is adjacent to the plant site, is listed as impaired for fish consumption for both mercury in fish tissue and PCB in the water column from an unknown source (KDEP 2014). The Ohio River segment associated with mercury-related impairment is the reach from just below Louisville to approximately 0.5-mile upstream of the Wabash River mouth (ORM 772.35 to 843.1, just above the SHF site), or approximately 11 percent of the 664 miles of the Ohio River (KDEP 2013a). This stretch is well upstream of SHF.

The reach of the Ohio River bordering Kentucky supports aquatic life and drinking water use. Primary contact recreation (water bodies suitable for full immersion swimming) is impaired for nearly 350 stream miles, or about 53 percent of the river in Kentucky. The pollutant causing this impairment is the pathogen indicator, *E. coli*. No reaches of the Ohio River fully support all assessed uses. This limitation is often a result of combined sewer overflows during and immediately following rainfall events along the riverfront and downstream of urban areas. The Kentucky reach of the Ohio River only partially supports fish consumption because of polychlorinated biphenyls (PCBs) and dioxin, while methylmercury residue in fish tissue is a cause of impairment in many of the river miles. The river reach from ORM 981.3 - 938.9, which is adjacent to the plant site, is listed as impaired for fish consumption for both mercury in fish tissue and PCB in the water column from an unknown source (KDEP 2014). The Ohio River segment associated with mercury-related impairment is the reach from just below Louisville to approximately 0.5-mile upstream of the Wabash River mouth (ORM 772.35 to 843.1, just above the SHF site), or approximately 11 percent of the 664 miles of the Ohio River (KDEP 2013a). This stretch is well upstream of SHF.

Proposed Landfill Site Water Features

Jurisdictional and non-jurisdictional streams and wetlands were delineated/characterized within the Shawnee East Site vicinity in October 2016 (AECOM 2016). The field survey of the Shawnee East Site documented surface water features that included nine ponds, two streams (total linear footage of 3,151.4) and two wet weather conveyances (total linear footage of 879.4) on the Shawnee East Site. A topographic map of the property also identifies an unnamed tributary of Little Bayou Creek that starts on the property and flows to the northwest. The USACE has performed a Jurisdictional Determination for the majority of the project area to determine wetlands and stream features that would require mitigation. All stream features noted in the project survey are located outside the Shawnee East Site, while two small ponds are within the proposed area of disturbance

(Figure 2). Refer to Section 3.13 for a separate discussion of wetland resources. Stream flow data were not available for the unnamed streams. The current Shawnee East Site was historically utilized for agriculture or is undeveloped. Drainage on the property generally flows to the northwest toward Little Bayou Creek. The southeastern survey area of the property (where the streams and wet weather conveyances are located) would drain to the northeast and ultimately discharge to the Ohio River through an unnamed tributary.

Existing SHF Wastewater Stream

SHF operates a surface water intake structure that withdraws an average of 543,019 million gallons per year, approximately 1487.72 million gallons per day (MGD), from the Ohio River for use as condenser cooling water (CCW) and plant process water (i.e., sluice water, fire protection, boiler feed water, safety eye wash and showers, and miscellaneous wash water). Approximately 98 percent of the water withdrawal is used for cooling, while approximately 2 percent is used for process water. The withdrawn water is returned to the river after appropriate treatment and is in compliance with SHF's KPDES permit.

There are several existing wastewater streams at SHF permitted under KPDES Permit Number KY0004219 (KDEP 2005): Outfall 002 (CCW); Outfall 004 (former chemical treatment impoundment that was closed in May 2016); and Outfall 001 (process and storm water discharges from the ash impoundment system). Potentially impacted onsite wastewater streams include the former SWL storm water discharge, CCW discharge channel, and ash impoundment discharge.

Because the ash impoundment discharge (Outfall 001) and the CCW discharge channel (Outfall 002) are the primary discharge points potentially affected by the proposed actions, they are the main focus of this discussion. About 25.75 MGD are discharged on average from the ash impoundment through Outfall 001. Outfall 001 discharges into the CCW discharge channel. The ash impoundment currently receives wastewater from a number of sources, as listed in Table 1.

The current SHF KPDES permit requires TVA to meet the ash impoundment effluent limits presented in Table 2. Existing KPDES permit limitations on the ash impoundment discharge are established for pH, oil and grease, total suspended solids, and acute toxicity. This permit also requires monitoring for hardness, flow, and reporting of 13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.

Approximately 1,490 MGD is discharged from the CCW discharge channel through KPDES Outfall 002. Outfall 002 discharges at ORM 946. The plant's permitted discharges from Outfall 002 are once-through CCW. The CCW itself should not be affected by the proposed project. However, because the ash impoundment (Outfall 001) discharges into the CCW discharge channel, Outfall 002 could be affected by this project by potential changes to Outfall 001. The current KPDES permit contains limitations on the CCW discharge for total residual chlorine and free available chlorine (no chlorine is added as part of normal operations), total residual oxidants and time of oxidant addition (no oxidants are added as part of normal operations), as well as thermal discharge (one million British Thermal Units per hour [MBTU/Hr]). The permit also requires reporting of flow, intake temperature, and discharge temperature.

Table 1. Sources and Quantities of Inflows to Ash Impoundment

Source	Average Annual Daily Inflow to Ash Impoundment (MGD)
Bottom Ash sluice water	19.44
Coal yard drainage basin (receives effluent from the chemical treatment impoundment and station sumps)	5.7105
Inactive and active ash disposal areas, dry ash stacking areas, coal/ash dredge cell	0.4101
Limestone storage area and sump	0.0084
Air preheater washing wastes	0.0040
Pressure washing waste, water treatment plant waste	0.1501
Portable hand wash stations	0.0001
Precipitation	0.1709
Ash impoundment seepage discharged to effluent ditch	- 0.017
Evaporation	- 0.1226
Total	**25.7545**

The current SHF KPDES permit requires TVA to meet the ash impoundment effluent limits presented in Table 2. Existing KPDES permit limitations on the ash impoundment discharge are established for pH, oil and grease, total suspended solids, and acute toxicity. This permit also requires monitoring for hardness, flow, and reporting of 13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.

Approximately 1,490 MGD is discharged from the CCW discharge channel through KPDES Outfall 002. Outfall 002 discharges at ORM 946. The plant’s permitted discharges from Outfall 002 are once-through condenser cooling water. The CCW itself should not be affected by the proposed project. However, because the ash impoundment (Outfall 001) discharges into the CCW discharge channel, Outfall 002 could be affected by this project by potential changes to Outfall 001. The current KPDES permit contains limitations on the CCW discharge for total residual chlorine and free available chlorine (no chlorine is added as part of normal operations), total residual oxidants and time of oxidant addition (no oxidants are added as part of normal operations), as well as thermal discharge (one million British Thermal Units per hour, MBTU/Hr). The permit also requires reporting of flow, intake temperature, and discharge temperature.

Table 2. Outfall 001 Discharge Limitations and Requirements

	Effluent Limitations				Monitoring Requirements	
	Monthly Average		Daily Maximum			
Effluent Characteristics	**Average Concentration (mg/L)**	**Average Amount (lb/day)**	**Average Concentration(mg/L)**	**Average Amount (lb/day)**	**Measurement Frequency**	**Sample Type**
Flow	Report (MGD)		Report (MGD)		1/Week	Weir
pH	Range 6.0 – 9.0 (s.u.)				1/Week	Grab
Total Suspended Solids	30	--	75	--	1/Month	Grab
Oil and Grease	12	--	14	--	1/Month	Grab
Hardness (as mg/L of $CaCO_3$)	Report	--	Report	--	1/Quarter	Grab
Total Recoverable Metals	Report	--	Report	--	1/Quarter	Grab
Acute Toxicity*	N/A	--	1.00 TU_a	--	1/Quarter	2 Grabs

Source: KPDES Permit Number KY0004219 effective July 13, 2005
mg/L = milligrams per liter,lb/day = pounds per day,MGD = million gallons per day s.u. = standard units
$CaCO_3$ = Calcium Carbonate
Total Recoverable Metals include: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc
*TU_a = acute toxicity unit; required quarterly.

<u>Existing Coal Combustion Residuals Waste Water Treatment Facilities</u>
SHF consumes an average of 2.7 million cubic yards of coal per year. SHF units produce on average 120,000 cubic yards of fly ash and 30,000 cubic yards of bottom ash per year (based on 2015 ash production), on a dry basis. The fly ash is pneumatically handled by a dry ash stacking system and the bottom ash is currently wet-sluiced to Ash Impoundment 2. A hydrated lime system for hydrogen chloride control injects hydrated lime into the flue gas, and any solid waste is captured in the baghouse with the fly ash and is stored in the onsite landfill. Future operations would add a dry flue-gas desulfurization (FGD) system to Units 1 and 4 and a bottom ash dewatering system. All CCR onsite is stored in the former SWL.

The CCR handling system at SHF includes Ash Impoundment 2; the coal yard drainage basin, which is pumped to Ash Impoundment 2; and the former SWL, which drains via storm water to Ash Impoundment 2. Ash Impoundment 2 discharges through Outfall 001.The maximum active area of exposed CCR in the former SWL is 10 acres. As stacking areas become inactive, they are stabilized with an interim cover, such as soil or bottom ash, for fugitive emission control, which is required on the unexposed or stabilized areas. The operational area within the former SWL is graded at the end of each day to limit ponding and encourage sheet flow runoff. Runoff from the former SWL is precipitation driven and flows to the Ash Impoundment 2.

Results of Impact Evaluation – Environmental Consequences to Surface Water Quality

No Action Alternative Analysis

Under the No Action Alternative, TVA would not construct the proposed projects. Solid waste would continue to be placed in the former SWL and wastewaters would continue to be treated by Ash Impoundment 2 in accordance with the KPDES permit. Wastewater discharges would continue to comply with all applicable permit limits and, therefore, surface water quality adjacent to SHF should remain approximately the same. All BMPs and work practices would continue.

Because the proposed CCR Landfill would not be constructed, eventually the former SWL would reach capacity. This could have impacts associated with plant operations, but should not impact wastewater discharges. In general, a balanced indigenous aquatic population exists in the Ohio River adjacent to SHF concurrent with existing plant operations and wastewater discharges to surface waters. Therefore, current operations do not appear to have had major negative impacts on surface water quality. Thus, continued operations at SHF under the No Action Alternative would not be expected to cause any additional direct or indirect impacts to local surface water resources.

Alternative B - Construction of Onsite Landfill and Closure of Existing Landfill and Ash Impoundment 2 Analysis

Construction Impacts

Wastewaters generated during construction of the proposed projects may include construction-related storm water runoff, drainage of work areas, non-detergent equipment washings and dust control, hydrostatic test discharges and sanitary waste discharges.

Soil disturbances associated with construction activities can potentially result in adverse water quality impacts. Soil erosion and sedimentation can clog small streams and impact aquatic life. TVA would comply with all appropriate state and federal permit requirements. A portion of the construction activities would be located on the plant property that already supports heavy industrial uses. The other area of the property has been historically used for agriculture. Appropriate BMPs would be followed, all proposed project activities would be conducted in a manner to ensure that waste materials are contained, and the introduction of pollutants to the receiving waters would be minimized. The Site Best Management Practices Plan, required by the KPDES permit, would be updated to include project-specific BMPs or a stand-alone project BMP plan would be prepared. This plan would identify specific BMPs to address construction-related activities that would be adopted to minimize storm water impacts.

Additionally, impervious buildings and infrastructure prevent rain from percolating through the soil and result in additional runoff of water and pollutants into storm drains, ditches, and streams. Any existing infrastructure within the projects limits of disturbance may be removed from the project site; however, they would be replaced with the proposed facilities, a new landfill, and capped impoundments thus altering the current storm water flows. A potion of the project area is within an industrial site and is partially covered with impervious structures or ground cover that decreases percolation. Construction would not significantly increase impervious surface area but it would increase it.. On the proposed landfill site, the area has little infrastructure or impervious cover therefore storm water flows would be altered significantly.

Storm water flow from the project areas would come primarily from concentrated flows not able to infiltrate through the impoundment caps, the Process Water Basin, or the storm water/leachate collection system (LCS) from the landfill area. These flows would be properly treated with either implementation of proper BMPs or by diverting the storm water discharges to an appropriate storm water outfall or impoundment for co-treatment.

Equipment washing and dust control discharges would be handled in accordance with BMPs described in the BMP Plan required by the site’s KPDES Permit KY0004219 to minimize construction impacts to surface waters.

Onsite hydrostatic testing will have the option to use potable or surface waters and would be covered under the current KPDES Permit KY0004219.

Sanitary wastes generated during construction activities would be collected by the existing sewage treatment system, on-site septic system(s) or by means of portable toilets (i.e., porta lets). These portable toilets would be located throughout construction areas and would be pumped out regularly, and the sewage would be transported by a vacuum truck to a publicly-owned wastewater treatment works that accepts pump out.

The approximately 205-acre Shawnee East Site would be used to provide borrow material for both the closure activities and for the proposed CCR Landfill. The potential borrow material has been evaluated to ensure that it can meet the required compaction requirements of the proposed designs and other specifications. The BMP Plan would cover any needed practices that would be required to ensure that no adverse impacts to surface water would be expected from the use of these borrow areas.

With the implementation of appropriate BMPs, only temporary, minor, impacts to surrounding surface waters would be expected from construction activities associated with impoundment/landfill closures and the use of the potential borrow areas.

Landfill construction activities could include, but are not limited to, the clearing and grading of the project site and grading of new separate storm water and leachate impoundments; the installation of the landfill facility (including liner and leachate collection fields) and the installation of a forced main to pump leachate to the EQ Basin. This proposed project would have similar temporary impacts during construction, as those noted above.

The proposed landfill project has the potential to require impacts to the wetlands and streams identified in the above mentioned wetland and stream characterization study(AECOM, 2016). If these streams are deemed by the US Army Corps of Engineers (USACE) to be jurisdictional, Kentucky Division of Water 401 Water Quality Certification and USACE 404 permits would be required which may require mitigation, such as on-site stream restoration or contributing to a stream mitigation bank, per permit requirements.

Operational Impacts

SHF Surface Water Withdrawal and Discharge Rates

The main withdrawal usage plant-wide is for the CCW, which carries the majority (99.9 percent) of the thermal loading from SHF discharges through Outfall 002. The thermal discharge loading at Outfall 002 would not be changed by the current proposed projects. Thermal discharges from Outfall 001 would also not change. Raw, potable, and storm water flows associated with these projects would remain at ambient temperatures; therefore, no additional thermal impacts would be anticipated. No additional surface water withdrawals would be anticipated from the proposed projects. The closure of Ash Impoundment 2 and the former SWL and the addition of the proposed CCR Landfill would potentially change the waste stream configuration of some of the internal process and storm water waste streams on the plant site. However, the volumes of the process flows, except the contact storm water discharges from the former SWL, would not be expected to change with the implementation of the proposed projects under normal conditions. There would be storm water and leachate discharges that would be generated from the proposed CCR Landfill, which would be new flows. However, with the closure of the former SWL, the contact storm water discharges (storm water which comes in contact with CCR materials) would be expected to decrease significantly, and non-contact storm water would be expected to increase from this location onsite.

Ash Impoundment and Special Waste Landfill Closures

As identified in the PEIS (TVA 2016b), closure in place of Ash Impoundment 2 would minimize surface water flow to the impoundment, which would enhance stability of the berms due to a reduction of hydraulic inputs. As all work would be done in compliance with applicable regulations, permits, and BMPs; potential impacts of this alternative to surface water would be negligible. The main operational change that would take place with the closure of Ash Impoundment 2 would be the change in management of the onsite storm water and process wastewater that is currently treated through this impoundment. CCR material in the northwest portion of Ash Impoundment 2 would be removed and hauled to the former SWL. A new perimeter dike would be constructed along the north and west boundary of the former SWL, and the remaining Ash Impoundment 2 dikes to the north would be removed along with any support structures. Once grading is complete, in-place closure of the former SWL would be performed. This work includes removing the cover soil on the former SWL followed by installation of a final soil or geomembrane cap system encompassing the entire area.

Portions of the Ash Impoundment 2 would be converted to Process Water Basin(s) where internal flows would be treated before being discharged to the CCW and ultimately to the Ohio River via Outfall 002. The Process Water Basin(s) would be designed and operated to ensure compliance with all CCR and KPDES regulations. Any discharges would comply with KPDES limits and KY Water Quality Standards to ensure in-stream water quality.

The existing outfall structures associated with Ash Impoundment 2 would either be utilized for wastewater discharge from the Process Water Basin(s) or would be removed and replaced with new ditches and/or outfall structures as needed to manage the storm water runoff from the closed impoundments and Solid Waste Landfill. Precipitation driven runoff should have much lower loadings of suspended solids, metals, and other constituents than current process wastewaters. Final drainage would be routed to existing or new discharge points and comply with the KPDES permit to ensure that no adverse impacts to surface waters would occur. Mitigation measures would be identified, as needed, to ensure the discharges meet permit limits. This may or may not require a permit modification. Additionally, all post construction contact storm water would be routed to the proposed Process Water Basin(s) or future wastewater treatment facility.

CCR Landfill Operational Impacts

The CCR by-products that would be placed in the landfill are expected to include fly ash, bottom ash, hydrated lime and by the end of calendar year 2017 dry scrubber waste (gypsum). By-product generation and characterization would be dependent on the coal source. The design coal for the CCR landfill considerations would be based on the current CCR production utilizing 100 percent powder river basin blend (PRB). However the ammonia model was evaluated considered a blend of 52/48 PRB and ILB coal .(TVA, 2014) This alternative coal blend was used for the evaluation of the ammonia model because at the time of the above referenced EA, that coal was deemed the future worse case coal blend. It is used again in this EIS because all future base information for ammonia in surface water is based on this coal blend.

The wastewater streams which could change substantively under this alternative are:

- The addition of the landfill leachate stream and storm water run-off.
- Non-contact surface runoff from the proposed landfill drainage area.

Details of the CCR by-product evaluation where expanded on from in the *Final SHF Unit 1 and 4 EA* (TVA, 2014). The estimated average leachate flow from the proposed landfill was estimated to be approximately 0.0815 MGD with a maximum peak flow of 0.968 MGD. (Stantec, 2016) The storm water run-off, based on the design storm of 24-hour and 100 year event, could be expected to have peak inflows of 155 MGD to each of the newly propped storm water ponds that would be included as part of the design for the proposed landfill project. The outlet discharges of these pond under the same conditions would expected to be approximately 12.6 MGD per pond. An estimated daily flow of 0.129 MGD from both storm water impoundments has been approximated based on the current level of design. Storm water flows from the site would be discharged from the proposed ponds and would discharge to a newly constructed ditch line and would be discharged through a new storm water outfall to the Unnamed Tributary of Little Bayou Creek to the west of the proposed new dry CCR landfill site. The Little Bayou Creek and the Unnamed Tributary of Little Bayou Creek are zero-flow streams. It would be assumed that in-stream water quality standards would need to be met at the outfall prior to mixing with the stream. Depending on the nature of this run-off stream mitigation measures that may include waste water treatment may be required prior to discharge to this stream.

On Site Landfill Leachate and Run-off

The CCR solids not beneficially reused would be trucked and placed in the proposed CCR Landfill. The proposed CCR Landfill would have a liner system and a leachate collection system. The leachate would be discharged to a leachate pond and then would be pumped to the proposed Process Water Basin(s). The Process Water Basin(s) would discharge via existing Outfall 001 or a new outfall to the CCW and ultimately through Outfall 002 to the Ohio River. Ammonia concentrations in the landfilled materials would be dependent on SCR process and plant specifics. If it is necessary to limit in-stream loading of landfill leachate, several studies by TVA have been conducted at SHF which would inform the process (TVA 2014, TVA 2017)

The leachate stream would be discharged to leachate pond(s) and then pumped to the new Process Water Basin(s) for treatment. The effluent from the basin(s) could then discharge through either Outfall 001 or a new outfall to the CCW and ultimately would be discharged through Outfall 002. These flows have the potential to be a higher concentration, low flow stream, alkaline in nature, with some detectable metals and ammonia levels. All waste streams would comply with KPDES permit limits and regulations. The leachate would be treated as required to meet all applicable KPDES permit requirements and in-stream water quality standards. Therefore, potential impacts to surface water under this alternative would be minor. Should the option be chosen to transport this by-product to an offsite landfill, this waste stream would be blended with leachate from other materials landfilled at that site and treated as necessary to comply with the offsite facility's permits.

Metals Loading

The concentration of metals in the Ohio River after receiving discharges from the former SWL were evaluated in the *Final SHF Fossil Plant Units 1 and 4 EA* after installation of a proposed dry flue gas desulfurization process and selective catalytic reduction technology on Units 1 and 4, which is in the process of being constructed . This evaluation was utilized and expanded upon for the evaluation of the proposed new by-product landfill.

To estimate the concentration of metals in the Ohio River after receiving discharges from the proposed by-product landfill, the maximum synthetic groundwater leaching procedure data was used. The SGLP data was used instead of the toxicity characteristic leaching procedure (TCLP) data because the SGLP data was deemed more appropriate to model leachate discharges because of the use of non-acidified water in the method. Additionally, this method allows for analysis of more parameters than the TCLP method.

In additional to the leachate loading and mixing evaluation, an evaluation was also performed to evaluated the contact storm water runoff from the proposed landfill to the Unnamed Tributary of Little Bayou Creek. In this evaluation storm water model flows were utilized. However rain water concentrations were used and assumed to be *de minimis* and were evaluated at half the MDL concentration.

The HELP Model was utilized to evaluate the proposed leachate collection system disposal facility. The drainage layers for the cap and liner systems as well as the leachate drainage pipe system would be designed to maintain less than 1 foot of leachate head above the liner system.(Stantec, 2017) Per the Final CCR Rule, the design of the leachate collection system would account for anticipated differential settlement of the liner. Leachate generation volumes would be used to size leachate storage pond(s). The design of the leachate storage pond(s) would also involve design of the following items:

• Compacted clay and geosynthetic membrane liner system

• Pump station and force main to convey leachate to proposed Process Water Basin

• Groundwater monitoring plan to detect potential leaks through the liner system

The added loadings from the by-product LCS discharge would be unlikely to increase the metals concentrations at the Ohio River where this stream would discharge. Additionally, the concentrations would not exceed KPDES water quality standards (Table 3). This analysis represents the estimated maximum discharges from this site, since the leachate flow used would be the peak flow during Phase III of the landfill operation. In addition, water quality standards are typically applied as an in-stream concentration after mixing.

Results of the mass balance analysis for the mixing of the leachate flow showed that the concentrations of the constituents of concern after mixing with the CCW and then the Ohio River would be at or below the Kentucky's lowest water quality standards, Even after accounting for the impacts of the by-product storage leachate, the impacts after mixing with the Ohio River would be minor. Additionally, TVA would conduct a characterization of the leachate and run-off streams to confirm no significant impacts to the Ohio River. The waters would be analyzed for metals and other parameters. If determined to be necessary, appropriate mitigating measures would be evaluated and implemented to ensure that the discharge KPDES permit requirements for the water quality parameters are met.

Table 3. Cumulative Impact of By-product Storage Leachate Total Mixed Concentration Estimate

Element	MDL (mg/L)	Background River Conc. (mg/L)	River Loading (lbs/day)	Dry FGD SGLP Conc. (mg/L)	BAS SGLP Conc. (mg/L)	Fly Ash SGLP Conc. (mg/L)	Landfill Leachate Conc. Estimates (mg/L)	Landfill Leachate Loading Estimates (lbs/day)	CCW Outfall 002 Conc. (mg/l)	CCW Loading Conc.(lbs/day)	Projected Mixing Conc. of Outfall 002 and Estimated Leachate (mg/L)	Instream Mixed Conc. in Ohio River 7Q10 (mg/L)	Instream Water Quality Criteria Conc., (mg/L)
Antimony	0.001	<0.001	249.553	0.0733	0.0005	0.0022	0.076	0.61342	<0.001	6.2149263	0.00055	0.00050	0.64000
Arsenic	0.002	0.0011	274.508	0.0012	0.0006	0.0023	0.004	0.03292	0.0011	13.67283786	0.00110	0.00110	0.15000
Beryllium	0.001	<0.001	249.852	0.0000	0.0000	0.00009	0.00015	0.00121	<0.001	6.2149263	0.00050	0.00050	0.00400
Cadmium	0.0005	<0.0005	124.926	0.0001	0.0000	0.00016	0.00026	0.00210	<0.0005	3.10746315	0.00025	0.00025	0.00036
Chromium	0.002	0.0031	124.926	0.0400	0.0007	0.0009	0.041	0.33492	0.0031	38.53254306	0.00312	0.00310	NL*
Copper	0.002	0.0026	649.615	0.0010	0.0002	0.0015	0.003	0.02170	0.0026	32.31761676	0.00260	0.00260	0.01289
Lead	0.002	0.0011	274.837	0.0005	0.0003	0.0013	0.002	0.01695	0.0011	13.67283786	0.00110	0.00110	0.00515
Mercury	0.0002	0.00000243	0.60714	0.0000	0.0000	0.0000	0.000	0.00050	0.00000243	0.030204542	0.00000	0.00000	0.00077
Nickel	0.002	0.0032	799.526	0.0003	0.0001	0.0011	0.002	0.01285	0.0032	39.77552832	0.00320	0.00320	0.07185
Selenium	0.001	<0.001	124.926	0.0038	0.0004	0.0057	0.010	0.07931	<0.001	6.2149263	0.00051	0.00050	0.00500
Silver	0.0005	<0.0005	62.463	0.0002	0.0001	0.0004	0.001	0.00557	<0.0005	3.10746315	0.00025	0.00025	0.00726
Thallium	0.001	<0.001	124.926	0.0003	0.0002	0.0009	0.001	0.01130	<0.001	6.2149263	0.00050	0.00050	NL
Zinc	0.025	0.0011	274.837	0.0024	0.0006	0.0018	0.005	0.03906	0.0011	13.67283786	0.00110	0.00110	0.16511

lbs/day = conc. in mg/L X flow in MGD X 8.34 lbs/gal.

Intake Flow	337.26	MGD	River flow and data from SHF 2010 NPDES Permit renewal application, Data from 2C sampling
Leachate worse case Phase 3 Flow	1.0	MGD	Leachate estimates for flow and chemical parameters taken from SGLP data - Flow from Stantec Help Model
CCW Flow	1490.39	MGD	CCW Flow from SHF KPDES Permit renewal application, data was taken from intake data and from 2C data sampling of Outfall 002
7Q10 River Flow	29922.3936	MGD	Flow to evaluate Human Health SHF Permit 2005
	146	mg/L	Intake hardness as CaCO3 from 2010 permit renewal 2C samples
ln of haedness	4.983606622		

*Mass Discharge and Loadings were calculated using 0.5 the Minimum Detection Limit

***KY Surface Water Standards, 401 KAR 10:31

No KY water quality standards for Total Chromium but there are standards for speicated Chromium, however there is no SGLP leachated data available for speciated Chromium at this time.

If maximum sample results show less than detect (all samples that have "less than sign"), 1/2 of the detection level was used in the loading and concentration calculations for that constituent sample where non-detection oc

Leachate data taken from SGLP data from DFGD waste, fly ash and bottom ash taken individually. FGD waste SGLP and percentage were taken from GAF, since DFGD is not in service yet.

DSN002 current concentrations from KIF 2008 NPDES Permit renewal application

Table 4. Cumulative Impact of By-product Storm Water Concentration Estimate

Element	MDL (mg/L)	Dry FGD SGLP Conc. (mg/L)	BAS SGLP Conc. (mg/L)	Fly Ash SGLP Conc. (mg/L)	Landfill SGLP Conc. Estimates (mg/L)	Landfill Storm Water Loading Estimates (lbs/day)	Rain Water Conc - Assume De Minimis (mg/L)	Landfill Storm Water Loading Estimates from SW Ponds (lbs/day)	Projected Mixing Conc. Rain Water with Landfill SGLP (mg/L)	Instream Water Quality Criteria Conc., (mg/L)
Antimony	0.001	0.0733	0.0005	0.0022	0.076	196.44645	0.0005	0.10508	0.07031	0.64000
Arsenic	0.002	0.0012	0.0006	0.0023	0.004	10.54171	0.001	0.21017	0.00385	0.34000
Beryllium	0.001	0.0000	0.0000	0.00009	0.00015	0.38781	0.0005	0.10508	0.00018	0.00400
Cadmium	0.0005	0.0001	0.0000	0.00016	0.00026	0.67220	0.00025	0.05254	0.00026	0.00313
Chromium	0.002	0.0400	0.0007	0.0009	0.041	107.25790	0.001	0.21017	0.03844	NL*
Copper	0.002	0.0010	0.0002	0.0015	0.003	6.94956	0.001	0.21017	0.00256	0.02000
Lead	0.002	0.0005	0.0003	0.0013	0.002	5.42934	0.001	0.21017	0.00202	0.13218
Mercury	0.0002	0.0000	0.000008	0.000032	0.000061	0.158547	0.000100	0.02102	0.00006	0.00140
Nickel	0.002	0.0003	0.0001	0.0011	0.002	4.11451	0.001	0.21017	0.00155	0.64621
Selenium	0.001	0.0038	0.0004	0.0057	0.010	25.39949	0.001	0.21017	0.00916	0.00500
Silver	0.0005	0.0002	0.0001	0.0004	0.001	1.78393	0.00025	0.05254	0.00066	0.00726
Thallium	0.001	0.0003	0.0002	0.0009	0.001	3.61956	0.0005	0.10508	0.00133	0.00047
Zinc	0.025	0.0024	0.0006	0.0018	0.005	12.50972	0.0125	2.62710	0.00541	0.16511

lbs/day = conc. in mg/L X flow in MGD X 8.34 lbs/gal.

SW worse case 100 yr, 24 hr	310.0	MGD	Storm water estimates for flow to SW Ponds - Flow from Stantec Help Model	
SW Discharge from Ponds Worse Case	25.2	MGD	Storm water estimates for flow from SW ponds discharges - Flow from Stantec Help Model	
	146	mg/L	Intake hardness as CaCO3 from 2010 permit renewal 2C samples	Intake hardness as CaCO3 from 2010 permit renewal 2C samples
ln of hardness	4.983606622			

*Mass Discharge and Loadings were calculated using 0.5 the Minimum Detection Limit

***KY Surface Water Standards, 401 KAR 10:31

No KY water quality standards for Total Chromium but there are standards for speciated Chromium, however there is no SGLP leachate data available for speciated Chromium at this time.

If maximum sample results show less than detect (all samples that have "less than sign"), 1/2 of the detection level was used in the loading and concentration calculations for that constituent sample where non-detection occurred.

Leachate data taken from SGLP data from DFGD waste, fly ash and bottom ash taken individually. FGD waste SGLP and percentage were taken from GAF, since DFGD is not in service yet.

Acute standards used because it is assumed that discharges from landfill will not exceed 4 days per week per EPA basis, except where no CMC standard is given.

The evaluation for the storm water loading from the proposed landfill does have the potential to increase the metals and ammonia concentrations in the Unnamed Tributary of the Little Bayou Creek. See Table 4 for details. A loading calculation was performed utilizing preliminary storm water flow data. The peek flow data was utilized from the 100 year, 24 hour storm. Flows were utilized going into the each storm water pond and the concentration was evaluated coming out of each storm water pond. Additionally, this loading and mixing calculation did not take into account any treatment in the storm water ponds. It would be assumed that in-stream water quality standards would need to be met at the storm water outfall prior to mixing with the stream, since the stream is a zero flow stream. The evaluation showed that all constituents evaluated would be below WQS, except for selenium and thallium. This may indicate that there may be a need for mitigation measures, which may include waste water treatment, prior to discharge from this outfall and should be taken into consideration in future designs and storm water discharges.

Ammonia Model

To avoid higher ammonia concentrations at Outfalls 001 and 002, the four potential sources of ammonia (APH wash water, SCR containment pond purge, proposed new and existing landfill discharges, and CCR silo runoff)were evaluated and characterized for operational knowledge in the *TVA SHF Units 1 and 4 EA.*. Any non-storm water releases from the SCR containment pond would be monitored and treated prior to discharge to the unwatering sump and ultimately the proposed Process Water Basin. If concentrations from these sources are deemed too high, then the streams would be released to the Process Water Basin singularly, sent offsite for proper disposal, or new treatment options and BMPs would be explored and implemented within the Process Water Basin. (TVA, 2014)

No direct negative (toxic) impacts on water quality of surface waters are anticipated, based on historical and modeled data, and ultimately as a result of the fact that the future Process Water Basin and new storm water discharges would be required to meet KPDES limits and KY WQS.

An ammonia model was used to evaluate the maximum ammonia releases from the dry stack runoff for the *TVA SHF Units 1 and 4 EA.* The model was based on extremely conservative assumptions regarding the amount of ammonia entering the river, the volume of ammoniated water released, and the flow of the river at the time of release. This model was utilized and adapted for the SHF CCR EIS evaluation of the proposed new landfill leachate stream and storm water runoff.

Ammonia slip, the emission of unreacted ammonia (NH_3), is caused by the incomplete reaction of the ammonia with NOx present in the flue gas. The unreacted NH_3 could react with available gaseous sulfuric acid to form ammonium bisulfate (NH_4HSO_4), a very sticky substance. Ammonia slip tends to adhere to or commingle with the fly ash, and/or build up on the APH interior surfaces. Formation of NH_4HSO_4 could accelerate the buildup inside the APHs, and make the periodic cleaning of the APHs more difficult.

$NH_3 + H_2O + SO_3 \Leftrightarrow NH_4HSO_4$

Approximately 20 percent of the NH_3 slip is expected to adhered to the heating surfaces in the APH, and about 80 percent adhered to the fly ash. The partitioning of ammonia slip between fly ash and APH heating surfaces will be determined by the specific equipment installed, actual fuel blends, and their operating characteristics. Best professional judgment was used in developing the estimates utilized in this EIS.

Ammonia Criteria

The current SHF KPDES permit requirements for the Outfall 001 discharge do not include limitations for ammonia concentrations; however, limits for acute toxicity are included and there are existing water quality criteria for ammonia. The acute criterion (criterion maximum concentration or CMC) for protection of aquatic life ammonia toxicity is defined as the 1-hour average concentration of total ammonia nitrogen (in mg N/L) that should not be exceeded more than once every 3 years on average. The CMC is not affected by temperature but does vary with pH. As the pH increases, the CMC decreases (Table5). The CMC for ammonia must be met at the Outfall 001 discharge point in accordance with regulations and KPDES permit requirements. (TVA, 2014)

Table 5. Maximum Allowable Ammonia Concentrations to Protect Aquatic Life From Acute Effects at Typical pH Levels

Acute Criterion (mg NH_3-N/L)						
pH 6.0	**pH 6.5**	**pH 7.0**	**pH 7.5**	**pH 8.0**	**pH 8.5**	**pH 9.0**
54.99	48.83	36.09	19.89	8.41	3.20	1.32

Note: Assumes salmonids are absent

Similarly, the chronic criterion concentration (CCC) for ammonia must be met in the receiving stream to protect the aquatic biota of the Ohio River. The CCC is defined as the 30-day average concentration not to be exceeded more than once every 3 years. In addition, the highest 4-day average within the 30-day period should not exceed 2.5 times the CCC. The CCC is dependent on both temperature and pH. As temperature and/or pH increases, the CCC decreases (Table 6). In addition to the above criteria, KDEP water quality standards limits the concentration of unionized ammonia in receiving streams to 0.05 mg/L. (KDEP, 2014)

Table 6. Thirty-Day Average Allowable Ammonia Concentrations to Protect Aquatic Life From Chronic Effects at Selected pH Levels

Chronic Criterion Concentration (CCC) (mg NH_3-N/L)				
Temperature (°F)	**pH 7.5**	**pH 8.0**	**pH 8.5**	**pH 9.0**
70	2.85	1.59	0.71	0.32
75	2.38	1.33	0.6	0.27
80	1.99	1.11	0.5	0.22
82	1.86	1.03	0.46	0.21
84	1.73	0.96	0.43	0.19
86	1.61	0.90	0.4	0.18

Note: Assumes salmonids are absent

Storm Water Runoff Loading

The 100-year, 24-hour, rainfall event would produce the worst-case ammonia mass loading to the PROCESS WATER Basin from the landfill leachate waste stream. Total leachate from the proposed landfill for this event is estimated to be approximately 0.968 MGD. The storm water run-off, based on the design storm of 24-hour and 100 year event, could be expected to have peak inflows of 155 MGD to each of the newly proposed storm water ponds that would be included as part of the design for the proposed landfill project. The outlet discharges of these ponds under the same conditions would expected to be approximately 12.6 MGD per pond.(Stantec, 2017).

For the estimated maximum byproduct CCR analysis, it was assumed that a rainfall event which generated runoff from the landfill would be routed directly to the CCW without intermediate treatment from either the ash pond or the proposed Process Water Basin. Dry FGD residue mixed with 52/48 PRB/ILB fly ash blend was the test basis. It was assumed that the exposed surface area of the stack had just reached maximum working capacity (10 acres) before having interim cover applied, and all of the ammonia stored in the top 1 centimeter of the exposed area would be released as runoff through the storm water pond and then the ash pond.

Ammonia was evaluated in the storm water run-off from the proposed landfill. This discharge may be discharged via a new storm water outfall to the Unnamed Tributary Little Bayou Creek. Flows were utilized going into the each storm water pond and the concentration was evaluated coming out of each storm water pond. Additionally, this loading and mixing calculation did not take into account any treatment in the storm water ponds. It would be assumed that in-stream water quality standards would need to be met at the storm water outfall prior to mixing with the stream, since the stream is a zero flow stream. The concentrations of the Total Ammonia as Nitrogen were found to below both the chronic and acute toxicity levels when the ammonia on ash was at its theoretical peaks as established in the TVA SHF Unit 1 and Unit 4 EA.

Leachate Evaluation

The leachate infiltration assumptions included the following:

Twenty percent moisture content on the CCR.

Particle density was assumed at 2.25 kg/L.

One hundred percent of the ammonia would be released from the CCR.

One pore volume of water dissolves all of the NH_3 in one unit volume of CCR.

Because the average concentration of ammonia in the fly ash was unknown for this process , a maximum allowable concentration was back-calculated based on the USEPA ammonia criteria at the ash pond discharge and the Ohio River mixing zone. The initial concentration of ammonia in the Ohio River was taken from 2010 NPDES permit renewal EPA Form 2C data. The concentration of the intake ammonia sample (<0.1 mg/L NH3-N) was selected as the concentration based on available data. Since the intake concentration was below detection, half of the detection limit was utilized for this calculations (0.05 mg/L NH3-N) If necessary, the ammonia-on-ash concentration would be restricted to ensure that the CMC would not be exceeded.

Under the conditions detailed in the *TVA SHF Unit 1 and Unit 4 EA,* the ammonia-on-ash concentration must not exceed 266 mg NH3-N/kg (combined ash mixing concentration would be 99.4 mg NH3-N/kg) in the winter months and 434 mg NH3-N/kg during the summer months, to ensure that the CMC would not be exceeded. These concentrations of ammonia on the ash were evaluated with the change in the flow configuration with the proposed new landfill with discharges from the leachate going directly into the CCW and then ultimately mixing with the Ohio River. To meet acute toxicity limits at these ammonia ash concentrations, the estimated discharge concentration should range be approximately 54.99 -1.32 mg/L of NH3-N from the Process Water Basin discharge, but the actual criteria is pH dependent. The lower the pH the higher the CMC criteria so, pH control may be required to make sure that ammonia as N concentrations, remain below the CMC criteria

The proposed Process Water Basin effluent would flow to the CCW discharge channel prior to entering the Ohio River. Complete mixing can be assumed in the discharge channel considering the turbulent conditions and the fact that the ash pond effluent enters the discharge channel approximately 1,270 feet upstream of the Ohio River. If the ammonia concentration at the Outfall 001 discharge is 1.32 mg NH_3-N/L due to storm water runoff, after mixing with the discharge channel flow (average flow of 1490 MGD) and the Ohio River (7Q10 flow: 29,910 MGD according to SHF KPDES Permit Number KY0004219), the concentration would be reduced to 0.049 mg NH_3-N/L. For all allowable pH levels at Outfall 002 (6.0 to 9.0 s.u.), and for very high water temperatures, the ammonia concentration at the Ohio River is less than the CCC (Table 4). Therefore, the worst-case ammonia loading from storm water runoff alone is expected to have an insignificant toxicity impact to the receiving stream.

Further characterization of ammonia-on-ash would be performed after start up and operation of the FGD and SCR systems utilizing actual coal blends burned and SCR ammonia slips. An actual NPDES action target would be calculated to ensure that the CMC would not be exceeded at Outfall DSN 001. TVA would conduct a characterization of the leachate and run-off streams to confirm no significant impacts to the Ohio River or the Unnamed Tributary to Little Bayou Creek. The waters would be analyzed for metals and other parameters. If determined to be necessary, appropriate mitigation measures would be evaluated and implemented to ensure that the discharge KPDES permit requirements for the water quality parameters are met.

Mitigation Measures

- **Baffling the Process Water Basin**
  Installation of baffles in the Process Water Basin would improve mixing of the inflow with the free water volume of the pond. Mixing of 75 percent to 100 percent could be attained. Baffling the basin would increase the retention time of the water, which would improve mixing, and allow more time for chemical degradation and/or biological uptake of the ammonia.

- **Combining Mitigation Measures and/or Use of Other Treatment Systems**
  A combination of the mitigation methods could be used to effectively control the ammonia concentrations at Outfalls 001, 002 and from in the Unnamed Tributary of the Little Bayou Creek. Other options include, but are not limited to, passive treatment systems, such as constructed wetlands; addition of media for enhancing growth of nitrifying microorganisms in the ash pond; installation of aeration devices to improve dissolved oxygen concentrations to enhance aerobic microbial degradation of ammonia; and installation of conventional treatment systems, such as air stripping, trickling filters, recirculating sand filters, or biological treatment systems.

Alternative C : CCR Disposal at a Permitted Offsite Landfill and Closure of Existing Landfill and Ash Impoundment 2

Under this alternative, impacts associated with closure of Ash Impoundment 2 and the former SWL would be the same as identified under Alternative B. CCR produced by SHF would be transported to an existing offsite permitted landfill. It is assumed that permits would be in place that would be protective of water quality. Because this is an existing permitted landfill, it is assumed that this landfill would be lined and would comply with all solid waste regulations.

Therefore, when BMPs are utilized, there would be no changes from the existing environment within the landfill boundaries under this alternative.

TECHNICAL WATER MEMORANDUM - LITERATURE CITED

AECOM. 2016. Final Report -Wetland Survey Shawnee Fossil Plant (SHF) McCracken County, KY. Prepared by AECOM, Franklin, TN November 2016.

Stantec 2016. TVA SHF, HELP Model Leachate and Storm Water Generation Estimates.

Kentucky Department for Environmental Protection (KDEP), Division of Water. November 2001. Total Maximum Daily Load (TMDL) Development – Polychlorinated Biphenyls (PCBs) – For Little Bayou Creek (McCracken County, Kentucky).

Kentucky Department for Environmental Protection (KDEP), Division of Water. September 1, 2005. KPDES No. FY0004219. Frankfort, KY

Kentucky Department for Environmental Protection (KDEP), Division of Water. October 3, 2013. Final 2012 Integrated Report to Congress on the Condition of Water Resources in Kentucky. Volume II. 303(d) List of Surface Waters.

Kentucky Department for Environmental Protection (KDEP). (Website updated September 22, 2014.) Kentucky Legislature, Kentucky Administrative Regulations, Title 401. (See http://www.lrc.state.ky.us/kar/TITLE401.HTM and http://www.lrc.state.ky.us/kar/401/010/031.htm) (accessed December 9, 2016)

Ohio River Valley Water Sanitation Commission (ORSANCO). Accessed October 16, 2014. “River Facts/Conditions.” (See http://orsanco.org/river-factsconditions)

Tennessee Valley Authority. 2014. Final Environmental Assessment, *Final SHF Fossil Plant Units 1 and 4 EA*, Chapter 3,McCracken County, Kentucky, December 2014 <https://www.tva.gov/file_source/TVA/Site%20Content/Environment/Environmental%20Stewardship/Environmental%20Reviews/Shawnee%20Fossil%20Plant%20Units%201%20and%204/Shawnee%20U1-4%20FEA.pdf>

Tennessee Valley Authority. 2016. Final Environmental Impact Statement, Ash Impoundment Closure, Part 1 – Programmatic NEPA Review, June 2016. https://www.tva.gov/Environment/Environmental-Stewardship/Environmental-Reviews/Closure-of-Coal-Combustion-Residual-Impoundments.

Tennessee Valley Authority, 2017. TVA Technical Memorandum – Shawnee CCR EIS NEPA Surface Water, A.C. Williams, January 27, 2017.

U.S. Army Corps of Engineers (USACE), Louisville District. Accessed October 16, 2014. “Olmstead Locks and Dam.“ (See http://www.lrl.usace.army.mil/Missions/CivilWorks/Navigation/LocksandDams/OlmstedLocksandDam.aspx).

Appendix I – Public Comments and Responses

APPENDIX I
Public Comments and Responses to Comments on the Shawnee Fossil Plant (SHF) Coal Combustion Residual (CCR) Management Draft Environmental Impact Statement

December 2017

This page intentionally left blank

Table of Contents

Appendix I – Public Comments and Responses

TVA released the Draft EIS on June 8, 2017 and the notice of availability was published in the Federal Register on June 18, 2017 initiating a 45-day public scoping period which concluded on July 31, 2017. In addition to the notice in the Federal Register, TVA sent notification of the availability of the Draft EIS to local and state government entities and federal agencies, published notices regarding this effort in local newspapers; issued a press release to media; and posted the news release on the TVA Website (see Appendix G).

TVA hosted a public meeting on June 22, 2017, at the Robert Cherry Civic Center located at 2701 Park Avenue in Paducah, Kentucky. Notification of the public meeting was sent to local residents adjacent to the SHF plant, and also was published in local newspapers. Local and regional stakeholders, governments, and other interested parties were also informed of the publication of the Draft EIS and provided information about the public meeting.

TVA accepted comments submitted through mail, email, a comment form on the public website, and at the public meeting. TVA received a wide variety of comments regarding the future management of CCR at SHF. TVA received a total of 83 comments from eight commenters. Of the eight submissions, three were from federal entities, one was from a state entity, one was from a group of environmental organizations, and three were from members of the public.

Comments were received in relation to the Draft EIS sufficiency and timing, ash contact with groundwater and release of CCR constituents, groundwater and surface water impacts, CCR Rule compliance, landfill site selection, closure-by-removal alternatives analysis, other disposal areas, beneficial reuse of CCR, and other general topics.

TVA carefully reviewed all of the substantive comments that were received. Summarized comments and TVA's responses are included below. The original comment submissions are included ifollowing the responses to comments.

1.1 Permitting and Terminology Changes from the Draft to Final EIS

The existing onsite landfill, formerly the Special Waste Landfill (SWL), had a state landfill permit. However, it is now considered a CCR Landfill under a Registered Permit-by-Rule with the Kentucky Division of Waste Management (KDWM) effective September 21, 2017. Although Ash Impoundment 2 still maintains an operating permit in accordance with the Kentucky Division of Water Kentucky Pollutant Discharge Elimination System (KPDES) Permit No. KY0004219, it also was transitioned to a Registered Permit-by-Rule under Kentucky's CCR Rule on September 21, 2017. In the Draft EIS released on June 8, 2017, the onsite landfill was called the SWL. For consistency with the Draft EIS the onsite landfill is referred to in the Final EIS as the former SWL.

1.2 DEIS Sufficiency and Timing

Comment 1: The DEIS suffers from numerous material flaws, procedural as well as substantive, which both render the DEIS legally defective and pose potential hazards to human health and the environment. Our conclusions are based on an intensive review of numerous technical documents (including TVA documents produced during past discoveries, documents produced by TVA on its CCR website, and many other publically available technical reports, among other materials) in conjunction with applicable laws and regulations.

We believe that TVA has not performed proper and adequate analyses necessary to defensibly select a preferred alternative for closure of current disposal units or for selecting a disposal site for long-term disposal of wastes. We believe that the DEIS and its proposed courses of action would, if finalized as they currently stand, violate the National Environmental Policy Act ("NEPA") and the CCR Rule, at least—potentially other laws as well (e.g., the Resource Conservation and Recovery Act ("RCRA") and/or the Clean Water Act, *inter alia*).

TVA should therefore refrain from implementing the DEIS, and should reconsider alternatives after it has properly addressed the flaws discussed herein. (*Commenter: Sierra Club*)

Response 1: TVA believes the analyses presented in the Draft and Final EIS comply with NEPA and the CCR Rule and all other applicable regulations. TVA believes the EIS analyses support the selection of the preferred alternative for closure of Ash Impoundment 2 and the Special Waste Landfill and selection of the Shawnee East Site as the location of the new CCR landfill.

TVA utilized a thorough process to identify and evaluate reasonable alternatives for closure of Ash Impoundment 2 and the former SWL and determination of a future disposal location for SHF produced CCR. The evaluation process included:

- Studies to evaluate preliminary alternatives considered for both future disposal and closure options. Both studies included ranking alternatives based on criteria as described in Chapter 2.
- Careful consideration of the purpose and need for TVA's proposed actions that inform the alternatives to be considered. This process included evaluation of the No Action Alternative, consistent with TVA's procedures and regulations promulgated by the Council on Environmental Quality (CEQ) that implement the National Environmental Policy Act (NEPA).
- A public scoping phase in which initial input from the agencies (federal, state), public, nationally recognized tribes, and other interested parties was sought on the alternatives that should be considered.

TVA believes the alternatives evaluated in the EIS are reasonable.

Comment 2: It should be noted that TVA completed the DEIS even though the current Special Waste Landfill (alternatively referred to as the "SWL" or the "Consolidated Waste Dry Stack") has enough capacity to last for another 10 years (until 2027), and the proposed new landfill would not be needed until that time. DEIS at [page] 1. As such, in addition to its other flaws noted below, the DEIS is premature at this point. This lack of urgency further counsels towards

TVA not moving ahead with finalizing the problematic proposals in the DEIS. (*Commenter: Sierra Club*)

> **Response 2:** TVA is modernizing its facilities and moving away from wet storage of CCR to dry lined storage across its fleet. Therefore, TVA is looking at closing Ash Impoundment 2 and the former unlined SWL at SHF. Given the time required for locating, permitting, and constructing a new lined landfill and recent reactivation of SHF Units 1 and 4 with the installed SO_2 scrubber systems which will produce larger quantities of CCR, TVA is proactively preparing to meet the need to replace the former SWL.

Comment 3: Based on our review, the EPA rated the DEIS as “EC-2” - or Environmental Concerns with additional information requested. The EPA identified environmental concerns associated with the proposed action and enclosed detailed technical comments and recommendations for your consideration (See enclosure). The EPA's environmental concerns primarily related to the long-term protection of water quality and fugitive dust emissions from SHF CCR operations. We recommend that the TVA adhere to federal and state permitting requirements related to water quality and necessary permits as well as best management practices that have been identified in the DEIS. (*Commenter: EPA*)

> **Response 3:** Comment noted. TVA responds to the individual comments and recommendations in the sections below. TVA will adhere to federal and state permitting requirements related to water quality and necessary permits as well as implement best management practices that have been identified in the Draft EIS.

Comment 4: Tennessee Valley Authority (TVA) identified the need for additional long-term storage of dry Coal Combustion Residuals (CCR) materials produced at SHF, as well as closing the existing wet storage impoundment and Special Waste Landfill (SWL). Recommendation: The Final Environmental Impact Statement (FEIS) should include a discussion or timetable on when the anticipated construction will begin on the Shawnee Fossil Plant (SHF) Bottom Ash Process Dewatering Facility because the current onsite SWL is expected to reach capacity by 2027. (*Commenter: EPA*)

> **Response 4:** Construction on the SHF Bottom Ash Process Dewatering Facility began in April 2017. The facility is expected to become operational in December 2018. This information has been added to Section 1.1.1 of the Final EIS.

1.3 Ash Contact with Groundwater and Release of CCR Constituents

Comment 5: TVA’s plan to “eliminate all wet storage” of CCRs through closure of Ash Impoundment 2 and the SWL would not eliminate the ash’s contact with groundwater, nor would it eliminate continued leaching of hazardous contaminants from those disposal areas. This renders TVA’s proposal unlawful under both applicable substantive legal requirements pertaining to CCR, and NEPA’s mandate for reasoned decision-making based on a record of fulsome, accurate analysis. (*Commenter: Sierra Club*)

Response 5: This commenter's concern is addressed by the post-closure groundwater monitoring requirements in the CCR Rule, which obligate owner-operators of closed CCR impoundments to perform thirty years of post-closure monitoring. See 40 C.F.R. § 257.104(b)(3). This includes the implementation of a corrective action program, if necessary. *Id.* (referencing the corrective action requirements).

Comment 6: TVA explains that it "deemed it appropriate to tier closure of the SWL from" TVA's 2016 Ash Impoundment Closure Final Environmental Impact Statement Part I Programmatic Review, or "PEIS," due to the SWL's "location with respect to Ash Impoundment 2 and the former footprint of Ash Impoundment 1." DEIS at [page] 26. TVA is correct in its determination of similarities to Ash Impoundment 2 because the SWL is in fact an "inactive surface impoundment" according to the CCR Rule. (*Commenter: Sierra Club*)

Response 6: The former SWL located on top of Ash Impoundment 1 is an active landfill and is permitted as such. Calling the former SWL an inactive impoundment is muddling the important distinction between the categories of units that are and are not regulated by the CCR Rule. The CCR Rule applies to the former SWL as an active landfill and TVA will manage closure of the former SWL in accordance with the CCR Rule requirements for active landfills.

Comment 7: TVA began sluicing both fly ash and bottom ash to Ash Impoundment 2 in 1971. ...Ash Impoundment 2 was constructed without a liner that complies with the CCR Rule. ...Nevertheless, TVA continues to sluice ash into the impoundment, and has also constructed an expansion of the SWL over that (unlined) impoundment. ...Given that TVA constructed Ash Impoundment 1 before constructing Impoundment 2, one can assume that Ash Impoundment 1 was also constructed without a liner.

The 2007 horizontal expansion of SWL—which, again, was constructed over what was originally Ash Impoundment 1—over Ash Impoundment 2 continues to current day. The horizontal expansion over the surface impoundment likely does not meet the current CCR Rule technical requirements for a new lateral expansion of a surface impound or landfill. (*Commenter: Sierra Club*)

Response 7: The CCR Rule was not in place in 2007 when the horizontal expansion of the former SWL was approved and permitted through KDWM. As of the effective date of the CCR Rule in October 2015, the former SWL, including the horizontal expansion, was an active landfill, and therefore the regulations associated with impoundments under the CCR Rule are not applicable. No horizontal expansion has occurred, or is planned to occur, after October 2015. The current proposed actions do not constitute a horizontal expansion of the former SWL.

Comment 8: Groundwater and leachate continue to seep from Ash Impoundment 2 onto the ground surface adjacent to the dikes. TVA stated that seepage along the southeast dike of that impoundment occurred for "nearly 20 years" and that the "repair" consisted of covering the wet discharges with a "graded filter." ...However, that "filter" does not eliminate or prevent continued seepage of leachate onto the ground surface. The seepage area is not an area that contains standing water in the impoundment. Therefore, the seepage is originating from saturated CCRs below the ground surface. (*Commenter: Sierra Club*)

> **Response 8:** The dikes are inspected regularly per the CCR Rule. No seepage has been identified since the effective date of the CCR Rule.

Comment 9: TVA has known since at least 1982 that ash in the impoundments is likely in contact with groundwater. Various TVA reports include data that demonstrate groundwater is mounded beneath Ash Impoundment 1 (the Special Waste Landfill) and that groundwater is, therefore, in contact with ash.

Existing boring log data indicates TVA sluiced wastes onto the original ground elevation under Ash Impoundment 1, and that groundwater saturates the wastes. As such, groundwater remained in contact with the wastes 30 years after TVA terminated wet sluice operations in that impoundment.

More recent data demonstrates that Ash Impoundment 2 also remains saturated, groundwater is in substantial contact (at least 15 feet) with the CCRs in Ash Impoundment 2, and ash was placed onto the original ground in that area to at least 310 feet MSL. The data indicate the strong likelihood that CCRs in both the SWL and Ash Impoundment 2 remain saturated and in contact with the uppermost aquifer. (*Commenter: Sierra Club*)

> **Response 9:** See Response to Comment 5. Further, based on TVA's and EPRI's analyses, either closure method will still improve groundwater quality (reduce groundwater impacts). If the groundwater level data referred to in the comment is from monitoring wells, it is important to note that there is substantial uncertainty in groundwater level data derived from old monitoring wells. Wells, which were sited well before the CCR Rule was enacted, were sited in the first groundwater encountered, and not necessarily in a continuous, connected water-bearing zone. They were placed to monitor first surficial water or the first saturated zone, as required by KDWM. Therefore, the groundwater level data from these wells is not necessarily a reliable indicator of whether water levels reflect the uppermost aquifer, as defined by the CCR Rule.

Comment 10: Analysis shows that the bottom portion of the SWL (i.e., Ash Impoundment 1) is an "inactive CCR surface impoundment" within the meaning of the CCR Rule because the impoundment still contains both solid CCRs and liquids. 40 C.F.R § 257.53 ("Inactive CCR surface impoundment means a CCR surface impoundment that no longer receives CCR on or after October 19, 2015 and still contains both CCR and liquids on or after October 19, 2015."). As such, the bottom portion of the SWL (Ash Impoundment 1) is subject to the significant applicable requirements as a "surface impoundment" under the CCR Rule, see, e.g. id. §§ 257.50(b)-(c); id. § 257.100(a) ("Inactive CCR surface impoundments are subject to all of the requirements of this subpart applicable to existing CCR surface impoundments."); id. § 257.100(e). The DEIS fails to take that status and its important attendant obligations into account, however. (*Commenter: Sierra Club*)

Response 10: The former SWL is regulated as an existing landfill under the CCR Rule. Also see responses to Comments 5, 6, 7, and 9.

1.4 Groundwater and Surface Water Impacts

Comment 11: TVA's own monitoring of groundwater and surface water demonstrates widespread contamination, and that contamination discharges into the receiving streams. However, TVA's plan for closure and construction of new disposal units would not prevent that discharge of contamination from occurring in the future, nor would existing permit conditions be able to quantify or mitigate the potential long-term adverse effects. (*Commenter: Sierra Club*)

Response 11: SHF complies with its KPDES permit and Kentucky Water Quality Standards (WQS). Surface Water discharges are currently treated in impoundments prior to release and as shown in the EIS Section 3.7 Surface Water. SHF submits effluent monitoring results to KDOW in monthly discharge monitoring reports (DMRs) that demonstrate that these discharges meet regulatory requirements. SHF also performs, as per its KPDES permit, toxicity testing once per quarter on ash impoundment effluent to ensure that discharges are not toxic. Whole Effluent Toxicity test results comply with effluent limitations in the KPDES permit, providing further evidence that discharges from SHF are not causing or contributing to an in-stream excursion of Kentucky WQS. Wastewater discharges from new lined processing basins and lined landfills will be required to meet KPDES limits and comply with Kentucky WQS.

Parts per billion levels of groundwater monitoring parameters identified in reports submitted to Kentucky Division of Waste Management meet all EPA drinking water maximum contaminant levels (MCLs). Despite this, the groundwater in this area is not allowed to be used due to a Department of Energy Water Policy boundary associated with groundwater contamination from uranium enrichment activities, and includes the entire SHF reservation.

The manner in which the former SWL and Ash Impoundment 2 will be closed essentially prevents the infiltration of rain into the ash. This is achieved by the installation of a geomembrane cap system that meets the EPA CCR Rule requirements. The removal of rain infiltration also removes the hydraulic head (water pressure) that drives constituents into groundwater. With the hydraulic head eliminated, groundwater conditions are expected to improve, which will be monitored and confirmed through the required 30-year post-closure groundwater monitoring. The CCR Rule relies on the post-closure care groundwater monitoring and corrective action program to address potential releases to groundwater from units that are closed in place.

A new CCR landfill will be constructed to meet all of the EPA CCR Rule requirements. This includes a bottom liner system including leachate collection, which removes the hydraulic head from rainwater mixing with CCR constituents while the landfill cell is open. The leachate is treated prior to release through the KPDES outfall.

Comment 12: Groundwater monitoring as recent as November 2016 (reported in January 2017) for the SWL and Ash Impoundment 2 indicated continued groundwater contamination due to leachate migration from unlined disposal units. See TVA 2017, at 11 and 12 (PDF pagination). TVA concluded that "statistical findings indicate the likelihood of coal-combustion by-product effects on groundwater beneath and downgradient of the Special Waste Landfill." Id. TVA concluded that three water-bearing units from shallow to deep were affected:

1. the alluvial soil aquifer;
2. the Upper Continental Deposits aquifer; and
3. the Regional Gravel Aquifer.

Nevertheless, TVA apparently did not evaluate the results of any wells associated with Ash Impoundment 2. That failure to evaluate was unreasonable. (*Commenter: Sierra Club*)

> **Response 12:** The wells for both background and downgradient monitoring of the former SWL also monitor Ash Impoundment 2. There is no way to monitor them separately. They are a multiunit under the CCR Rule. Prior groundwater reports were submitted as required for the former SWL permit. That requirement did not include discussing Ash Impoundment 2, and is why it is not mentioned in the reports. Statistical exceedances will be addressed in a few ways. First, the cap and final cover system are expected to control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of rain water into the ash in both the former SWL and Ash Impoundment 2. Second, the former SWL also will be subject to 30 years of post-closure groundwater monitoring and corrective action, as necessary, if any exceedances are confirmed from the closed unit above the applicable groundwater protection standards. See 40 CFR 257.95. Third, the liner and cap system of the proposed new CCR landfill will meet the CCR performance standards. This system includes a geomembrane liner and leachate collection system.

Comment 13: TVA stated in the DEIS that its proposed new landfill (Option 1, reference to as the "Shawnee East Site") will be designed with a leachate collection system and that leachate will be "sent to the onsite processing impoundment where it would be conveyed to the Ohio River through a Kentucky Pollutant Discharge Elimination System ("KPDES") permitted outfall." DEIS at [page] 21. However, TVA:

- failed to explain which impoundment will receive that leachate;
- failed to explain whether that unit is or will be lined to protect groundwater quality; and
- failed to explain how that impoundment will "process" that leachate to be protective of receiving streams and groundwater. (*Commenter: Sierra Club*)

> **Response 13:** Leachate will be collected in the leachate collection system, which is a part of the design of the new landfill. It will then go to a lined leachate pond in the immediate vicinity of the proposed landfill. Leachate would then be pumped to the proposed new lined Process Water Basin(s) (to be constructed). The Process Water

Basin(s) is described in Subsection 2.2.2 of the Final EIS. That facility will discharge through a permitted KPDES outfall and be operated in compliance with all local, state, and federal regulations. Subsection 3.7.2.2.2 Onsite Landfill Leachate and Runoff describes how this waste stream would be treated. These flows have the potential to be a higher concentration, low flow stream, alkaline in nature, with some detectable metals and ammonia levels. Ammonia concentrations in the landfilled materials would be dependent on SCR process and plant specifics. If it is necessary to limit in-stream loading of landfill leachate, several studies by TVA have been conducted at SHF which would inform the process (TVA 2014, TVA 2017). All waste streams would comply with KPDES permit limits and regulations. The leachate would be treated as required to meet all applicable KPDES permit requirements and in-stream water quality standards.

Comment 14: The DEIS states that all future discharges to local surface waters will be protective because the discharges will be in accordance with the existing KPDES permit and in compliance with Water Quality Standards. See DEIS at [pages] 81-83. Yet that claim is misleading, because the Shawnee permit does not include any numeric limitations for any metal, nor does it include all constituents (e.g., boron, sulfate) that are known to be in the groundwater due to leakage from the unlined surface impoundments. Absent such numeric limits along with an understanding of the assimilative capacity, the fish and aquatic life, and the benthic invertebrate conditions in the receiving streams, TVA cannot confidently claim that current and future discharges will be protective of human health and the environment. (*Commenter: Sierra Club*)

Response 14: KPDES permits and the established Kentucky water quality standards are presumed to be protective of jurisdictional waters. The EIS did evaluate the reportable metals and evaluate the changes that were anticipated with the proposed actions and, associated anticipated discharge rates and concentrations, to better show potential impacts. The discharge complies with the state standard for fish and aquatic water quality standards. As described in Subsection 3.11.1, “The mORFIn condition ratings of good to very good, based on electrofishing data, indicate that the river study area adjacent to SHF supported its designated aquatic life use classification both upstream and downstream of the facility. In contrast to electrofishing, the net fishing data showed minimal spatial differences, and species richness was the same upstream and downstream… Analysis of historical trends in the scores and other measures indicate an improving fishery near SHF (EPRI 2014).” Additionally, mitigation measures were also noted that may include rerouting of waste stream or water treatment to ensure limits and WQS are met. This further indicates TVA's commitment to minimizing impacts of these actions.

Comment 15: TVA stated in the DEIS that closure of the SWL and Ash Impoundment 2 and the construction of the proposed Shawnee East Site landfill will change the water quality that is discharged into streams—yet TVA has offered no definitive plans on how it plans to treat the wastewater. TVA referred to a pair of studies that TVA performed to “inform the process,” see DEIS at [page] 83, but it failed to include the results of those studies in order to propose a plan for leachate and stormwater treatment prior to discharging into receiving streams. Therefore, TVA cannot claim that its future discharges will be protective of human health and the fish / aquatic life of the receiving streams. (*Commenter: Sierra Club*)

> **Response 15:** See response to Comment 11. The studies referenced were a previous EA, which is a public document available at: https://www.tva.gov/Environment/Environmental-Stewardship/Environmental-Reviews/Shawnee-Fossil-Plant-Units-1-and-4, and the SHF CCR EIS Technical Water Memorandum, which was mistakenly not included in the appendices of this EIS document. TVA has included the Technical Water Memorandum as Appendix H in the Final EIS to provide clarification of the results of the studies or models produced to evaluate surface water impacts. In addition, Section 2.4 of the EIS addresses mitigation measures TVA would implement with Alternative B: (1) Any discharges during construction and operation activities would comply with KPDES limits and Kentucky Water Quality Standards to ensure in-stream water quality; (2) The leachate would be pumped to a basin and would be treated as required to meet all applicable KPDES permit requirements and in-stream water quality standards; (3) TVA would conduct a characterization of the leachate and runoff streams to confirm no significant impacts to the Ohio River or the Unnamed Tributary to Little Bayou Creek; (4) The discharge waters would be analyzed for metals and other parameters. If this analysis shows that further treatment is necessary, appropriate mitigation measures, which could include the rerouting of this waste stream to either the proposed Process Water Basin(s) before discharge to the Ohio River, would be evaluated and implemented to ensure that the discharge limits in the KPDES permit are met.

Comment 16: TVA concluded that "no direct impacts to aquatic ecosystems of the Ohio River or Little Bayou Creek would occur in conjunction with construction of the proposed Shawnee East Site landfill or closure of the SWL and Ash Impoundment 2. DEIS at [page] 103. That claim is baseless, because TVA has not collected any aquatic information from Little Bayou Creek, the Ohio River in the area of the Shawnee Plant, the unnamed tributary into which runoff from Shawnee East Site landfill will be discharged, or ponds and wetlands located on Shawnee East Site. See DEIS at [page] 100-101. TVA should have performed an aquatic survey of all of those water-bodies and presented the results in the DEIS. (*Commenter: Sierra Club*)

> **Response 16:** The aquatic community of the Ohio River has been surveyed near SHF for decades. Though detailed ecological surveys have not been performed for the smaller water bodies, such surveys are not warranted given the small areas potentially affected, the lack of unique or important habitats for rare species, and the mitigation that would occur to compensate for wetland losses.

Comment 17: TVA stated in the DEIS that water generated from a proposed new bottom ash dewatering facility could either be discharged into a receiving stream or be "recirculated back into the system." DEIS at [page] 175. TVA should have included that analysis in the DEIS and that analysis should have included recirculation of all wastewaters to result in zero discharges to receiving streams. (*Commenter: Sierra Club*)

Response 17: See TVA's environmental evaluations for dewatering systems in the Dewatering EA. TVA's 2016 Shawnee Fossil Plant Bottom Ash Process Dewatering Facility Final Environmental Assessment evaluated the construction and operation of the dewatering facility. The dewatering facility EA is available at: https://www.tva.gov/Environment/Environmental-Stewardship/Environmental-Reviews/Shawnee-Fossil-Plant-Bottom-Ash-Process-Dewatering-Facility.

The analysis related to zero liquid discharge requested in this comment is outside of the scope of this EIS.

Comment 18: TVA has not yet quantified in the DEIS how either the proposed Closure-in-Place alternative for the SWL or Ash Impoundment 2 or the construction of the proposed Shawnee East Site landfill will affect baseline surface water and groundwater conditions, or how those closures will improve groundwater and surface water quality. Moreover, TVA acknowledged that Closure-in-Place is less protective of groundwater when compared to Closure-by-Removal, and that it is uncertain that Closure-in-Place with a cap over the wastes will even improve groundwater quality when ash is in contact with groundwater. See TVA 2016, Appendix A at [page] 29. Given the proximity of the SWL and Impoundment 2 to rivers and streams and the ineffectiveness of a cap upon closure to prevent saturated wastes from continuing to contaminate groundwater that flows into streams, one can expect contaminated groundwater to flow into receiving surface waters for the foreseeable future. (*Commenter: Sierra Club*)

Response 18: TVA disagrees with the assumptions and conclusions set forth in Comment 18 and notes that EPA determined in the CCR Rule that "both methods of closure (*i.e*., clean closure and closure with waste in place) can be equally protective, provided they are conducted properly. [80 Fed. Reg. 21412 (April 17, 2015)]. As stated in the PEIS: ""TVA's analyses confirm EPA's determination in the CCR Rule that Closure-in-Place and Closure-by-Removal are equally protective if done properly. Part I, Section 3.6 of the Final PEIS provides details concerning benefits to groundwater resulting from implementation of Closure-in-Place. Dewatering an impoundment and preventing infiltration of runoff and precipitation by capping the impoundment reduce the hydraulic head and this reduces the movement of coal ash constituents into the groundwater. Even when CCR is in contact with groundwater, dewatering and capping an impoundment should reduce contamination risks. The level of reduction would be less than if CCR is excavated and removed when it is in in contact with groundwater, but it would be rare that groundwater is not improved." (TVA 2016) Closure with waste in place is protective in part because the CCR Rule provides for thirty years of post-closure care and corrective action if necessary.

In addition, in response to comments like Comment 18, EPA considered the potential implication of groundwater saturated CCR (CCR that is below the groundwater table) on its risk conclusions and concluded that "this uncertainty is unlikely to have an appreciable effect." EPA, *Human and Ecological Risk Assessment of Coal Combustion Residuals*, 5-10 - 5-11 (December 2014).

TVA expects closure will reduce groundwater impacts relative to baseline (current) conditions. Here, Sections 3.6 and 3.7 of the Draft and Final EIS describe the potential impacts of closure of the former SWL and Ash Impoundment 2 on groundwater and surface water respectively. Also, see responses to Comments 11 and 12.

Comment 19: The proposed project is subject to Division of Water (DOW) jurisdiction because the following are or appear to be involved: Environmental Impact Statement. Prior approval must be obtained from the DOW before construction can begin. The applicant must cite the State Application Identifier (SAI #KY201706090756) when submitting plans and specifications to the DOW. (*Commenter: Kentucky Clearinghouse/Kentucky Department for Environmental Protection*)

Response 19: Comment noted. TVA will obtain approval from the DOW prior to commencing construction.

Comment 20: Little Bayou Creek and Bayou Creek traverse the western portion of the site. Little Bayou Creek is impaired for the warm water aquatic life use due to beta particles and photon emitters, copper, gross alpha, cause unknown, lead and polychlorinated biphenyls. Bayou creek is impaired for the warm water aquatic life use due to beta particles and photon emitters, copper, gross alpha, lead, mercury, nutrient/eutrophication biological indicators, and sedimentation/siltation. Metropolis Lake, to the east of the project area is an exceptional and outstanding state resource water. The Ohio River, just downstream of the site, is an outstanding state resource water due to the presence of federal threatened and endangered species. (*Commenter: Kentucky Clearinghouse/Kentucky Department for Environmental Protection*)

Response 20: Comment noted. Section 3.7.1 has been updated to include this additional information.

Comment 21: The proposed work is endorsed[*] by the Groundwater Section of the Watershed Management Branch. However, it is our recommendation that site be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area with the proposed Groundwater Monitoring within the Environmental Impact Statement. [* An endorsement of this project does not satisfy, or imply, the acceptance or issuance of any permits, certifications, or approvals that may be required from this agency under Kentucky Revised Statutes or Kentucky Administrative Regulations. Such endorsement means this agency has found no major concerns from the review of the proposed project as presented other than those stated as conditions or comments.] (*Commenter: Kentucky Clearinghouse/Kentucky Department for Environmental Protection*)

Response 21: Comment noted. TVA will update the SHF Groundwater Protection Plan (GPP) for the protection of groundwater resources within the area, including proposed groundwater monitoring.

Comment 22: If the construction area disturbed is equal to or greater than 1 acre, the applicant will need to apply for a Kentucky Pollutant Discharge Elimination System (KPDES) storm water discharge permit. (*Commenter: Kentucky Clearinghouse/Kentucky Department for Environmental Protection*)

> **Response 22:** SHF has an individual KPDES permit for the discharge of other wastewaters which requires the development and implementation of a Best Management Practices (BMP) Plan. TVA will maintain this permit and would coordinate any necessary permit modifications with the KDEP.

Comment 23: The proposed COCs [contaminants of concern] that will be analyzed for monitoring of groundwater, did not include PAH [polycyclic aromatic hydrocarbon] constituents. They proposed to primarily monitor for metals. PAH contamination could be a potential COC in fly ash from coal where it definitely is a COC concern. (*Commenter: Kentucky Clearinghouse/Kentucky Department for Environmental Protection*)

> **Response 23:** EPA addressed this issue directly in the preamble of the CCR Rule. In response to a comment that proposed including PAHs, among other organic constituents, in evaluation of CCR units, EPA citied its own findings that PAHs and other organics were not risk drivers and analysis of groundwater samples for these constituents is not justified (page 21444 – documented comment and relevant portions of EPA response provided below).
>
>> COMMENT: Multiple commenters noted that there may be additional constituents present in CCR wastes beyond those quantitatively evaluated in the risk assessment. In particular, multiple commenters referenced organics and radionuclides. Some commenters called on EPA to quantify the risks associated with these additional constituents. Others claimed that these constituents are present in low levels and do not pose risk to receptors.
>>
>> EPA RESPONSE: In the <u>Report to Congress: Wastes from the Combustion of Fossil Fuels: Volume 2 – Methods, Findings, and Recommendations</u>, EPA reviewed the available data on organic constituents, such as polyaromatic hydrocarbons and dioxins. These data indicated that concentrations of all organics are near or below analytical detection limits both in CCR and in the leachate released from CCR. Based on the findings of this report, the Agency concluded that organic constituents were not risk drivers and did not require further evaluation. In the absence of additional data that demonstrate the organic composition of CCR wastes have markedly changed, EPA continues to rely on these findings.

TVA will follow all applicable local, state, and federal regulatory requirements for groundwater monitoring **Comment 24:** In Section 2.4 of the DEIS, general statements concerning wetlands and/or stream crossings and stream alterations are provided. The DEIS does not detail what type of crossing and or stream alterations would be subject to requirements outlined in a Clean

Water Act Section 404 permit or what impacts to jurisdictional waters are anticipated. TVA also provided general information in the DEIS about the General Storm Water Construction Permit for this project. In addition, Section 1.7 of the DEIS indicates that TVA will evaluate the proposed actions to determine if a modification to the Kentucky Pollutant Discharge Elimination System permit or notification to Kentucky Department of Environmental Protection will be required due to potential alteration of the wastewater stream(s). Recommendations: The EPA recommends further information in the FEIS regarding potential permitting requirements and jurisdictional stream and wetland impacts associated with the new landfill and other facilities. The EPA also recommends that the FEIS include more detail concerning how additional stormwater from the new landfill would be addressed in order to ensure future compliance with state and federal requirements and how wastewater generated from the dewatering or decanting process and seeps will be addressed. (*Commenter: EPA*)

Response 24: See responses to Comments 11 and 12 regarding stormwater and wastewater impacts. The mitigation measure for wetlands discussed in Section 2.4 of the Final EIS has been revised as follows:

- Actions involving wetlands and/or stream crossings and stream alterations would be subject to requirements outlined in federal Clean Water Act Section 404 . An approved jurisdictional determination by the USACE determined that only a 0.7-acre wetland on the Shawnee East Site would require a Section 404 permit for impacts that could occur in conjunction with clearing, excavating, or grading during landfill construction. Where impacts to wetlands cannot be avoided, the Section 404 permitting program would require mitigation to offset impacts, and these mitigation measures would be clarified at the end of consultation with the USACE. TVA would obtain and adhere to all conditions stipulated in the permit.

1.5 CCR Rule Compliance - Closure Performance Standards

Comment 25: TVA’s plan for Closure-in-Place of the Special Waste Landfill and Ash Impoundment 2 would not satisfy the closure performance standards for surface impoundments legally required by the CCR Rule. (*Commenter: Sierra Club*)

Response 25: TVA disagrees. TVA’s Closure-in-Place plans for Ash Impoundment 2 and the former SWL would be in compliance with the closure performance standards (listed in 257.102 (d) i-v.) required by the CCR Rule.

Comment 26: In describing the preferred alternative, TVA failed to define what "visible" means with respect to "visible ash", how deep the ash will be excavated, or how many cubic yards will be excavated. (*Commenter: Sierra Club*)

Response 26: The removal of visible ash is defined in SHF’s Construction Quality Control Plan for Ash Impoundment 2 and the former SWL as follows:

> The complete removal of CCR materials from the designated areas and the determination of non-CCR material shall be field verified by visual observation

and documented by photographs in the project records by the CQC Team. The presence of CCR materials shall be determined by color and consistency of the exposed surface materials. Materials predominately black or dark gray in color with the consistency of ash shall be deemed CCR materials, removed and placed in the stacking area. Materials predominately brown in color with the consistency of native soil shall be deemed native soils and may remain on site. A grid system shall be established for observation locations following sediment excavation.

TVA has determined that no visible CCR equates to 10% or less of CCR materials being present. TVA shall review and approve the verification results in writing prior to placement of any fill or vegetative cover. TVA plans to excavate to the original ground level, then cover it with clay and regrade the area.

Comment 27: TVA has still not provided essential groundwater information that is needed to justify its selection of the Closure-in-Place alternative. Indeed, TVA selected the Closure-in-Place alternative without providing the following basic, important information necessary to support such a method:

1. Depth to groundwater within the CCRs;
2. Depth of CCRs relative to the three hydraulically connected uppermost aquifers already identified by TVA;
3. The amount of groundwater mounding that is currently present and how much the proposed cap will actually reduce that mounding effect;
4. The quantity of leachate that is currently seeping downward and into groundwater and how much the proposed cap will reduce or eliminate that leakage to groundwater;
5. How much groundwater flows laterally from up-gradient areas and into the CCRs in order to prevent all contact of groundwater with wastes;
6. How leachate and groundwater flows into and interacts with the receiving stream;
7. Soil permeability and hydraulic conductivity conditions beneath the wastes to estimate how fast leachate seeps vertically and horizontally; an
8. The horizontal groundwater flow velocities in the Alluvial Aquifer, the Upper Continental Deposits Aquifer, and the Regional Gravel Aquifers, as defined by TVA as being present. (*Commenter: Sierra Club*)

Response 27: See responses to Comments 5, 9, 11, and 12. The alluvium and UCD deposits are water-bearing units. The RGA is the principal aquifer underneath SHF as described in Section 3.6.

Comment 28: TVA's Preferred Alternative for Closure-in-Place of the SWL and Ash Impoundment 2 allows for continued discharge of contaminated groundwater, leachate, and surface water runoff into Little Bayou Creek and the Ohio River because CCRs will remain in contact with groundwater. As a result of the continued "wet" CCR waste conditions, one can expect vertical and horizontal seepage of contaminated groundwater and leachate to continue to flow into deeper portions of the underlying aquifer(s), into Little Bayou Creek, and into the Ohio River. (*Commenter: Sierra Club*)

Response 28: See responses to Comments 5, 9, 11, and 12.

Comment 29: TVA's plan for Closure-in-Place of the SWL and Impoundment 2 does not include complete removal of all water in the impoundments—including both standing water in the surface impoundments and the saturated pore water deeper in the wastes. Instead, TVA only plans to "decant" or remove the water standing in open areas of surface impoundments. See, e.g., DEIS at [pages] 3, 37.

TVA's plan of only removing standing water on top of the CCR and not removing all liquids from within the saturated ash will not remove the mounding of subsurface liquid in the CCR. That mounding creates a higher-than-normal hydraulic gradient (i.e., the slope of the groundwater) that will continue to form leachate that can more rapidly infiltrate into the groundwater—even after construction of cap during Closure-in-Place.

By contrast, as EPA has explained, the law requires otherwise: In order to close a unit with waste in place, the facility must meet all of the performance standards in § 257.102(d). If the facility is unable to meet the performance standards for closure with waste in place for a particular unit, it must clean close the unit. EPA 2017; see 40 C.F.R. § 257.102. (*Commenter: Sierra Club*)

Response 29: The closure-in-place performance standards require the prevention of *post-closure* liquids from infiltrating the waste through the final cap and cover system. *See* 40 C.F.R. § 257.102(d)(1)(i). They also require that impoundments be dewatered and stabilized sufficient to support the final cover system, 40 C.F.R. § 257.102(d)(2). Any releases to groundwater from CCR remaining in the closed unit are addressed, as necessary, during the minimum of 30-years of post-closure care.

Comment 30: "Clean close" means Closure-by-Removal, which involves excavating the wastes and re-disposing that waste into a lined landfill. If the wastes are submerged in groundwater or otherwise remain "wet" by a proposed Closure-in-Place method, that closure alternative will *not* meet the CCR Rule requirement for complete dewatering. EPA 2017. EPA has provided the following clarification of that requirement:

Whether any particular unit or facility can meet the performance standards for closure with waste in place is a site-specific determination that will depend on a number of factual and engineering considerations, such as the hydrogeology of the site, the engineering of the unit, and the kinds of engineering measures available. For example, if a small corner of a unit is submerged in the underlying aquifer, a facility might be able to meet the performance standard for closure with waste in place for the majority of the unit, by "clean closing" the submerged portion of the unit, and installing the necessary engineering measures to ensure that the rest of the unit meets the performance standards in § 257.102(d). Id. (*Commenter: Sierra Club*)

Response 30: See responses to Comments 5 through 9, 25 and 29.

Comment 31: Construction of a cap during Closure-in-Place will not prevent lateral inflow of groundwater into the CCRs from hydraulically up-gradient areas where such wastes are placed within and below the top of the groundwater. The lateral inflow groundwater that flows through the CCRs will continue to form more leachate and contaminate groundwater that flows into Little Bayou Creek and the Ohio River. (*Commenter: Sierra Club*)

Response 31: See responses to Comments 5, 9, and 12. TVA is still evaluating the aquifer separation demonstration and will post the results of that demonstration to TVA's CCR website in late 2018. Under Closure-by-Removal, Ash Impoundment 2 and the former SWL would not have a cap in place throughout the removal period. Therefore, infiltration would continue for potentially as long as an additional 62 to 68 years at the rates of removal for this quantity of material, (approximately 26 million cubic yards). TVA will close the units per the performance standards in the CCR Rule, monitor the units post closure, and perform corrective actions if needed.

Comment 32: In order for a closure plan to be compliant with EPA's closure performance standard for leaving CCRs in-place, the plan must meet the following performance standards related to leachate control and groundwater protection, among other listed obligations:

> (d) Closure performance standard when leaving CCR in place—
>
> (1) The owner or operator of a CCR unit must ensure that, at a minimum, the CCR unit is closed in a manner that will:
>
> (i) Control, minimize, or eliminate to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;
>
> (ii) Preclude the probability of future impoundment of water, sediment, or slurry; […]
>
> 40 C.F.R. § 257.102(d) (*Commenter: Sierra Club*)

Response 32: Comment noted. See response to Comments 25 and 29.

Comment 33: In light of the facts that TVA's own data indicate that CCRs are submerged in groundwater, and that water remains impounded in both the SWL and Ash Impoundment 2, TVA cannot meet the CCR Rule performance standards for Closure-in-Place. Accordingly, the DEIS's Preferred Alternative for Closure-in-Place would be unlawful—and potentially dangerous. (*Commenter: Sierra Club*)

Response 33: TVA does not agree that CCRs are submerged in groundwater. See responses to Comments 5 through 9.

1.6 CCR Rule Compliance - Location Restriction Requirements

Comment 34: Nowhere has TVA shown that its plan to laterally expand the Special Waste Landfill over Ash Impoundment 2 would satisfy the location restriction requirements legally required by the CCR Rule. (*Commenter: Sierra Club*)

> **Response 34:** See response to Comment 7. TVA has no plans for further lateral expansion of the former SWL. The proposed actions as described in Chapter 2 are for closure of Ash Impoundment 2 and the former SWL, including consolidation of a portion of Ash Impoundment 2 as a component of closure. TVA's closure plans for the former SWL would satisfy the unstable areas location restriction requirement.

Comment 35: TVA's plan to horizontally expand the existing SWL over Ash Impoundment 2 requires that TVA meet Location Restrictions specified in the CCR Rule because that would constitute a lateral expansion of an existing CCR unit. The DEIS fails to address, as it should, how TVA plans to meet these restrictions. These significant CCR Rule restrictions include, *inter alia*, the following:

1. <u>Placement Above the Uppermost Aquifer</u>, 40 C.F.R. § 257.60 – Requires 5-foot separation between the base of the landfill and the uppermost aquifer.
2. <u>Wetlands</u>, id. § 257.61 – Requires that no new landfill or a lateral expansion of an existing unit be located in wetlands unless specific arguments are made.
3. <u>Fault Areas</u>, id. § 257.62 – Requires that new landfills or a lateral expansion of an existing unit not be located within 60 meters of the outermost damage zone of a fault that has had displacement in Holocene time, unless the owner demonstrates an alternative setback distance will prevent damage to the structural integrity of the landfill.
4. <u>Seismic Impact Zone</u>, id. § 257.63 – Requires that new landfills and lateral expansions must not be located in seismic impact zones unless the owner demonstrates that the structural components will be designed to resist the maximum acceleration in lithified earth material.
5. <u>Unstable Areas</u>, id. § 257.64 – Requires that new landfills and lateral expansions must not be located in an unstable area unless recognized and accepted good engineering practices are incorporated into the design. Unstable areas can include wet, saturated or shallow groundwater soil conditions (as an example) that might result in differential settling due to disposal. (*Commenter: Sierra Club*)

> **Response 35:** See response to Comment 34. The former SWL is a landfill as described by the CCR Rule. As the former SWL is not a new landfill, it is only required to meet one of the above-listed CCR location restrictions. TVA will post all required demonstrations at the appropriate time.

Comment 36: First, TVA claims that the Preferred Alternative of closing the SWL and Ash Impoundment 2 in-place and constructing a new CCR landfill will have "no impact on floodplains as all actions would occur outside of floodplains." DEIS at [page] 89. That statement is misleadingly inaccurate, because TVA constructed the current Ash Impoundment 2 (and the proposed SWL expansion) within the 100-year floodplain—i.e., the blue-colored area in Graphic 7, below, as provided by TVA. TVA intends to modify the northwest portion of that impoundment (also likely within the original floodplain) by removing existing dikes; building a new Equalization Basin (also within the likely original floodplain), and building another horizontal expansion over Ash Impoundment 2 (also within the likely original floodplain). As such, under the DEIS's proposal, that work would be constructed within what likely used to be the 100-year floodplain, as defined by TVA. See DEIS at [page] 87. (*Commenter: Sierra Club*)

> **Response 36:** In accordance with the 1978 Floodplain Management Guidelines for Implementing EO 11988, the current effective FIRMs are used when determining whether a proposed action would be located within a floodplain. The current effective FIRM, McCracken County, Kentucky, Map Number 21145C0045F, published November 2, 2011, depicts the former SWL as being located outside the 100-year floodplain. The former SWL will not be expanded horizontally. See Comment 37.

Comment 37: From the application data, the [KY Division of Water] ascertains that the proposed alternatives will not impact the 100 year floodplain. No formal approval is required for Water Withdrawal Permitting or Water Management Planning. (*Commenter: Kentucky Clearinghouse/Kentucky Department for Environmental Protection*)

> **Response 37:** Comment noted.

Comment 38: The DEIS reveals no on-site investigation performed by TVA to identify local faults beneath any disposal area. TVA concluded that "while there are quaternary faults located in the Metropolis, Illinois area across the Ohio River, none are currently known within the SHF boundaries or immediate vicinity (USGS 2014). Therefore, impacts associated with ground fault rupture would not be anticipated." DEIS at 67. TVA is required to *know* if the units are located in fault areas. See 40 C.F.R. § 257.63. Nonetheless, TVA failed to perform such analyses and include them in the DEIS; rather, TVA appears merely to have made untested—and potentially grave—assumptions to that end. TVA acknowledges in the DEIS the importance of locating faults and in the near vicinity because it concluded that "the best mitigation for potential fault ground rupture to structures is to accurately locate the fault and set back structures a safe distance from the fault," DEIS at 67—yet, again, it still failed to undertake and discuss those analyses. DEIS at 67.

My preliminary analysis of the Shawnee site using existing, publically available geologic information indicates, for one, that the expansion area may not be suitable for the lateral expansion because of the likely presence of faults in that area and the presence of an active seismic zone. (*Commenter: Sierra Club*)

> **Response 38:** TVA is currently conducting a location demonstration in accordance with CCR Rule performance standards for both closure of Ash Impoundment 2 and the new CCR landfill. The fault area demonstration for Ash Impoundment 2 will be complete by October 2018. The demonstration for the new landfill will be complete prior to construction of the new landfill and receipt of any waste. Any identified deficiencies or

unacceptable seismic risks will be addressed through appropriate mitigative measures that may include rock toe, soil berm construction, and concrete/steel pile installation, or other measures, as appropriate. Prior to receiving waste at the new landfill, TVA would obtain a Kentucky state registered permit by rule. The former SWL will not be expanded horizontally.

Comment 39: The Kentucky Geological Survey ("KGS") concluded in a study for the nearby Paducah Gaseous Diffusion Plant, located approximately 2 miles to the southwest of the Shawnee site, that these fault conditions exist (see KGS 1997, at 5-6):

a) Faults of young (Quaternary and Tertiary) rocks were confirmed across the Ohio River, in Illinois.

b) Those faults and associated lineaments are northeast trending towards the TVA Shawnee Plant, as shown below in Graphic 8 (see KGS 1997, at 5-6).

c) The faults extend from the surface to the Precambrian basement and possibly deeper.

d) The faults mapped at the Gaseous Diffusion Plant "are probably the surface manifestations of buried Fluorspar Area Complex faults." Id.

e) In all likelihood, the area around the Gaseous Diffusion Plant is "intensely faulted." Id.

f) The number of identified earthquake centers in the plant area indicates "active faults at depth near the plant." Id.

g) The northeast-trending faults are significant because they likely control the direction of groundwater flow and groundwater migration pathways.

Given the likely presence of faults beneath the TVA Shawnee property, TVA should have performed its own site-specific investigation prior to developing the DEIS. Had TVA performed the simple analysis above based upon the foregoing publically available information, at the least, it would (and should) have determined that a more in-depth analysis was required for the DEIS. And needless to say, that information should have been included in the DEIS.

The analysis that I performed indicates that faults and active seismic conditions likely exist at the property. See 40 C.F.R. §§ 257.62, 257.63. As such, TVA's plan for Closure-in-Place and construction of the proposed Shawnee East Site landfill may not meet the CCR Rule's location restriction performance standards—and may pose serious hazards. (*Commenter: Sierra Club*)

Response 39: See response to Comment 38.

1.7 Beneficial Reuse of CCR

Comment 40: TVA failed to include, as it should have, analysis of beneficial reuse, in evaluating waste alternatives. Currently disposed and future wastes are capable of being beneficially reused in commercial products. Factoring in that analysis could materially change the relative economics of, and therefore TVA's informed choice between, the different alternatives.

TVA stated (near the end of the DEIS) that CCRs can be beneficially reused "in the manufacture of wallboard, roofing, cement, concrete, and other products," and that "CCR not sold for reuse are currently managed at the SWL." DEIS at 161. TVA did not discuss any plans or include any beneficial reuse options in its alternatives analysis in the DEIS. Further, TVA never stated how much (if any) CCRs are sold, have been sold in the past, or otherwise beneficially used in any commercial product. TVA's statement in the DEIS that operation of the proposed Shawnee East Site landfill "would not change the quantity of CCR wastes generated at SHF annually" suggests that TVA does not intend to beneficially reuse CCRs in any commercial product. Id. at 163.

TVA has partnerships with third party companies at other TVA coal-fired power plants to beneficially reuse CCR as raw material substitutions for commercial products. For example, at the TVA Cumberland Fossil Plant, flue-gas desulfurization ("FGD") wastes are used to manufacture wallboard at an adjacent manufacturing plant. TVA should have included such an analysis and consideration for identifying third-party uses in its alternatives analysis in the DEIS.12

TVA estimated that its proposed plan to build the Shawnee East Site landfill will be needed to meet a 10 to 20 million cubic yard total capacity as part of its desired 20-year comprehensive disposal plan, and that 8 million cubic yards will be generated between 2020 and 2044. See DEIS at ES-1 and 9. Such large capacity and associated costs would be unnecessary if TVA instead developed and initiated a comprehensive plan to beneficially reuse future wastes to reduce the costs and land area that it says is needed for disposal (i.e., 140 acres—not including buffer, roads, leachate pond, etc.).

If TVA were to beneficially reuse current and future wastes, its alternative analyses and its 20-year (or 25-year) plan would change, because less disposal acreage and lower transportation costs (as non-exhaustive examples) would be required. At the very least, the omission of any meaningful discussion of the potential for beneficial reuse of CCR from Shawnee specifically was unreasonable; TVA's decision-making cannot lawfully stand without it. (*Commenter: Sierra Club*)

> **Response 40:** TVA pursues beneficial reuse whenever feasible. With the installation of the dry scrubbers at SHF, the plant will no longer produce fly ash as a discrete stream. The fly ash is captured in the baghouse with the dry scrubber product, resulting in one blended material. There is currently no commercial beneficial use for dry scrubber material containing fly ash.

Beneficial reuse of bottom ash requires it to be free of mill rejects. The current configuration at SHF does not allow for segregation and would require installation of a separate handling system for the mill rejects. TVA is initiating studies to determine the feasibility of installing systems to handle mill rejects separate from bottom ash.

Comment 41: TVA's alternatives analysis for evaluating all disposal sites overstated the costs of disposal—assuming that TVA would have instead considered in the DEIS waste reductions through beneficial reuse. Because the CCR could otherwise be substituted as a raw material in future commercial products for sale, the CCR wastes could have instead been considered a revenue source rather than an expense in the DEIS. Waste reductions would result in less required acreage for disposal, less transportation costs, etc. that would have reduced the overall costs of the alternatives. (*Commenter: Sierra Club*)

Response 41: See response to Comment 40.

Comment 42: Section 3.20.1.4 of the DEIS mentions the types of beneficial uses of coal combustion solid waste. However, the analysis does not state how the TVA is currently using or will use coal ash in "other products." Recommendation: The EPA requests that TVA provide additional discussion on the TVA's intent to utilize or manage coal ash as a product. The FEIS should include a discussion about how this beneficial use will/may extend the life expectancy of the newly proposed CCR landfill. (*Commenter: EPA*)

Response 42: See responses to Comments 40 and 41. The most prevalent uses for fly ash are as a replacement for Portland cement in concrete and as raw feed for cement manufacture. Any use of fly ash requires that the ash be collected separate from the dry scrubber product. With the installation of the dry scrubbers at SHF, the plant will no longer produce fly ash as a discrete stream. The fly ash is captured in the baghouse with the dry scrubber product, resulting in one blended material. There is currently no commercial beneficial use for dry scrubber material containing fly ash.

The most common use for bottom ash is as a lightweight aggregate. This requires the bottom ash to be free of mill rejects. The current configuration at SHF does not does not allow for segregation. TVA is initiating studies to determine the feasibility of installing systems to handle mill rejects separate from bottom ash.

1.8 Alternatives Analysis - Dry Landfill Site Selection

Comment 43: TVA apparently completed a detailed analysis in 2015 of potential land disposal options. The details of that analysis were reportedly described in a 2015 New Landfill Siting Study mentioned by TVA—yet that was not included in the DEIS. See id. at 9. Given the significance of that evaluation and the results needed to support TVA's Preferred Alternative, TVA should have included that detailed, complete 2015 analysis in the DEIS. That unreasonable omission, like others noted herein, unlawfully renders the public unable to meaningfully review TVA's decision-making and informedly judge the legal adequacy as well as the practical safety and wisdom of the DEIS's plan. (*Commenter: Sierra Club*)

Response 43: The landfill siting study was discussed with the public at the November 15, 2016 scoping meeting and at the public meeting on June 22, 2017. Detailed maps associated with all of the landfill site alternatives were presented at the scoping meeting and are included in Appendix A of the Draft and Final EIS. TVA staff were available at both meetings to discuss the study with all meeting attendants. Comments received during the scoping period related to the alternative sites were addressed in the Scoping Report presented in Appendix A of the Draft and Final EIS. The Landfill Siting Study has been included as an Appendix G in the Final EIS.

Comment 44: The Shawnee East Site does not however, meet TVA's stated minimum 140-acre footprint that TVA stated it needed for 8 million cubic yards capacity. See DEIS at [page] 9. As such, TVA should have determined that the site was unsuitable because it did not meet its minimum requirement. (*Commenter: Sierra Club*)

Response 44: Landfill design is an iterative process. Initially, it was presumed that a larger footprint would be required to accommodate a shorter and flatter embankment (resulting in a larger footprint) due to certain geotechnical considerations. Further site characterization and engineering analyses supported a later determination that the Shawnee East Site met the required embankment configuration and associated footprint needed for the 8 million cubic yard capacity.

Comment 45: TVA states that the Shawnee East Site would be designed to meet the CCR Rule siting and composite liner requirements. DEIS at [page] 20-21. The CCR Rule requires that new landfills have a composite liner system that provides minimum 5 feet of separation between the base of the landfill and the uppermost aquifer. 40 C.F.R. § 257.60. TVA's plan to use the Shawnee East Site landfill as a "borrow area" to obtain soils to construct the cap over the SWL and Ash Impoundment 2 will remove the already existing thin layer of soil above the uppermost aquifer at that site. See DEIS at [pages] 37, 39. In other words, TVA plans to excavate soil that might otherwise provide the 5-foot buffer legally required by the CCR Rule. TVA relied upon the Soil Data Mapper created by the Natural Resources Conservation Service ("NRCS") to determine soil conditions at the proposed Shawnee East Site landfill site. DEIS at [page] 59. I performed a similar analysis using the same Soil Data Mapper to evaluate if shallow groundwater conditions exist in the soil at that site. My analysis indicates that the proposed site likely does not have adequate soil thickness to meet the required 5-foot separation between the base of the landfill and uppermost aquifer, as required in the CCR Rule, even before excavating soils for use as borrow material, as proposed.

The NRCS reports very shallow groundwater in the soil at the proposed landfill site—in fact, the deepest groundwater at the site is reportedly no more than 20 inches below ground surface. NRCS 2017 at 3. Even worse, the area in red below illustrates soil conditions with a groundwater table—i.e., the "uppermost aquifer"—approximately 6 inches below the ground surface. The groundwater table depth within the brown areas was only approximately 12 inches deep. As such, the Shawnee East Site likely cannot meet the CCR Rule requirement for separation from the uppermost aquifer. See 40 C.F.R. § 257.60.

TVA should have performed the simple aforementioned analysis prior to including the Shawnee East Site in its list of potential disposal site alternatives in the DEIS. TVA chose to use the same Soil Data Mapper to identify soil types that I used to generate the shallow groundwater conditions above, and yet TVA failed to use that same source to determine shallow groundwater conditions. (*Commenter: Sierra Club*)

> **Response 45:** Piezometers and investigatory wells were installed as part of site hydrogeological characterization. Resulting data/trends were used for landfill design. A minimum five feet of vertical separation exists between recorded highest readings (accounting for hydrostatic pressures that were considered) and landfill subgrade. This satisfies criteria defined in the CCR Rule. Note that temporary perched conditions realized during/after a storm event on soil hardpan do not qualify as an aquifer. Further note that NRCS analyses are used to analyze soil for agricultural purposes and not for water supply or other site hydrogeologic characterization means, including design.

Comment 46: TVA identified 19 wetlands totaling 22.4 acres on the proposed property, with 4.13 acres being present within the proposed CCR landfill footprint; TVA also identified numerous farm ponds. ...With these wetlands on the Shawnee East Site in mind, TVA has failed to make a showing in the DEIS that might overcome the CCR Rule's rebuttable prohibition against CCR landfills and impoundments on wetlands. See 40 C.F.R. § 257.61

Further, the locations of wetlands and farm ponds are where one would expect them to be on the property: in the areas with the shallowest groundwater table according to the NRCS. Given the widespread shallow groundwater conditions at the Shawnee East Site, the site likely does [not] meet the new CCR landfill location restriction for separation with the uppermost aquifer according to the CCR Rule and may not even be suitable as a soil borrow area. As soil is excavated to obtain borrow material to construct the cap for the SWL and Ash Impoundment 2 Closure-in-Place, one would expect more shallow ponds to form at the Shawnee East Site.

The DEIS's discussion of groundwater conditions at the Shawnee East site acknowledged only the deeper Regional Gravel Aquifer; it failed to confront the shallower Alluvial Aquifer and the Upper Continental Deposits Aquifer that are both likely present at the site. TVA's groundwater discussion of the Shawnee East site concluded that the potentiometric surface (of an unspecified aquifer) varied substantially from winter to summer months, with a maximum elevation of 357 feet MSL. When that elevation is compared to the current ground surface elevations illustrated below in Graphic 12 (see USGS 1982), that groundwater elevation is within 3 feet of the lowest ground surface elevation for that property (360 ft. MSL). As a result, the site does not provide the required 5-foot separation according to the CCR Rule. (*Commenter: Sierra Club*)

> **Response 46:** Wetlands were defined with USACE concurrence and will be mitigated in accordance with applicable regulations. Note that across the landfill footprint, the embankment will be constructed within excavated areas (subgrade generally encased relative to surrounding ground). Additional borrow that is obtained from other site locations will be excavated in a manner to promoterun-off, not detention following certain

storm events. This is unlike current site conditions where surface water is detained due to certain topographical conditions that do not promote positive drainage. Also see responses to Comments 35 and 45.

Comment 47: TVA's preliminary alternatives analysis to evaluate future "dry" landfill disposal sites to accommodate Shawnee's waste generation plan was unreasonably brief; moreover, it resulted in the selection of land that was already purchased by TVA, that does not meet TVA's minimum designated acreage requirement, and that likely would not meet the CCR rule site location standards. (*Commenter: Sierra Club*)

Response 47: See responses to Comments 43 through 46. TVA conducted a siting study that evaluated multiple alternatives for the location of the new landfill. Completion of that siting study resulted in the acquisition of the Shawnee East Site during the limited window when it was available to keep available the possibility to use this site for potential multiple uses in the future pending completion of all reviews and studies.

Comment 48: In summary, my review of the DEIS in conjunction with publically available data reveals that the Shawnee East Site landfill likewise appears to violate the CCR Rule's Location Restrictions. See 40 C.F.R. §§ 257.60–257.64. TVA should have included in-depth analyses of how the proposed site might meet the applicable restrictions and obligations. (*Commenter: Sierra Club*)

Response 48: See responses to Comments 43 through 47. TVA is currently conducting demonstrations for the new CCR landfill/Shawnee East Site for wetlands, seismic impact zone, fault areas, aquifer separation, and unstable areas. The results of these demonstrations will be posted to TVA's CCR website in accordance with the CCR Rule.

1.9 Alternatives Analysis - Closure-by-Removal

Comment 49: TVA's elimination of Closure-by-Removal as a facility-wide alternative in the DEIS was not based upon reasonable facts and considerations that TVA should have considered in its analysis.

TVA concluded in the DEIS, that both Closure-in-Place and Closure-by-Removal of surface impoundments can be "equally protective of human health and the environment, provided they are implemented properly." DEIS at [page] 24. Given that TVA's plan for Closure-in-Place does not meet the CCR Rule performance standards, as discussed herein, TVA's plan for Closure-in-Place is not as protective as Closure-by-Removal. (*Commenter: Sierra Club*)

Response 49: See responses to Comments 50 through 54.

Comment 50: TVA's concluded in the PEIS that Closure-by-Removal would have a "greater beneficial impact on surface water and groundwater quality than Closure-in-Place if the water table intersects the CCR." TVA 2016, at [page] 32. TVA also confirmed a similar reduction of groundwater contamination in the DEIS for Shawnee when Closure-by-Removal is used. See

DEIS at 24. Given that groundwater saturates the wastes in the SWL and Ash Impoundment 2, Closure-by-Removal would be a more protective closure alternative. (*Commenter: Sierra Club*)

Response 50: As previously described in Appendix A, the Response to Comments on the Draft PEIS, TVA's analyses confirm EPA's determination in the CCR Rule that Closure-in-Place and Closure-by-Removal are equally protective of groundwater if done properly. Part I, Section 3.6 of the Final PEIS provides details concerning benefits to groundwater resulting from implementation of Closure-in-Place. Dewatering an impoundment and preventing infiltration of runoff and precipitation by capping the impoundment reduce the hydraulic head and this reduces the movement of coal ash constituents into the groundwater. Even when CCR is in contact with groundwater, dewatering and capping an impoundment should reduce and eventually eliminate constituents moving into groundwater. Also as described in the PEIS, Closure-in-Place has fewer impacts in association with transportation and health and safety than Closure-by-Removal, particularly for sites like this one that have substantial quantities of CCR material.

Comment 51: TVA concluded that the CCR Rule requires a “5-year closure window” for Closure-by-Removal as a reason why such closure was not reasonable. DEIS at 35. That conclusion fails to recognize that the EPA allows an owner to apply for an extension for closure. See 40 C.F.R. § 257.102(f). Such an extension allows for reduced transportation trips, as an example, which would invalidate some of TVA’s assumptions that eliminated Closure-by-Removal as being feasible. (*Commenter: Sierra Club*)

Response 51: EPA purposefully structured its CCR Rule to encourage utilities to accelerate the closure of CCR impoundments because of the decrease in groundwater risk and increased structural stability that results from eliminating the downward hydraulic pressures of ponded water. These pressures are often referred to as “hydraulic head” which is defined as the force exerted by a column of liquid expressed by the height of the liquid above the point at which the pressure is measured. As promulgated, EPA excluded impoundments that are closed by April 2018 from the rule’s other substantive requirements. It said: “EPA adopted this approach to create an incentive to expedite the closure of these units, with all of the significant risk mitigation that such a measure would entail” (80 FR 21302-21408 [April 17, 2015]). TVA identified 10 of its impoundments in Part II of the Draft PEIS that could be closed quickly.

On April 18, 2016, after release of the Draft PEIS, EPA asked the D.C. Circuit Court of Appeals to remand and vacate the accelerated closure incentive in a partial settlement of litigation challenging the CCR Rule (environmental groups argued that the rule had been improperly promulgated). This does not affect EPA’s technical determination that accelerated closure will significantly reduce structural failure and groundwater impact risks. Because of this pending regulatory change, TVA decided not to use the April 2018 incentive closure date as a significant factor in its consideration of the reasonableness of Closure-in-Place or Closure-by-Removal. Instead, TVA takes into account the five-year timeframe that EPA set for completing impoundment closures, 40 CFR §257.102(f). EPA determined that almost all impoundments could be closed within that period absent "unpredictable or variable conditions." 80 Fed. Reg. 21422. An early closure is environmentally preferable to a later closure, and this fact—recognized by EPA—still remains an important consideration in TVA's analyses.

Additionally, in the Draft EIS, the Closure-by-Removal option was evaluated considering removal activities occurring 365 days a year. In the final EIS, the Closure-by-Removal option was reevaluated using a more accurate 150 days per year based on the need to dewater and dry the ash before transport. Therefore, Closure-by-Removal would require a total of approximately 72-79 years for removal by truck or rail respectively. Including extensions, the CCR Rule allows for a limited amount of time, up to 15 years. Therefore, the time required for Closure-by-Removal exceeds a reasonable extension.

Comment 52: TVA and Stantec assumed that wastes that would be excavated and hauled off-site in a Closure-by-Removal closure would be hauled to an off-site landfill, rather than evaluating hauling and disposing of that wastes into an on-site landfill on property already owned by TVA. If TVA would have instead considered an on-site landfill in their analysis, the costs for transportation would have been minimal: No tipping fee would have been paid for disposal; larger trucks could be used to reduce truck trips per day; and no off-site impacts would be realized due to off-site transportation (e.g. noise, truck traffic). (*Commenter: Sierra Club*)

Response 52: Including extensions, the CCR Rule allows for a limited amount of time, up to 15 years, in which to do closure-by-removal. As described in Table 2.1-2, closure-by-removal of Ash Impoundment 2 would require -21 to 23 years and closure-by-removal of the former SWL would require 72 to 79 years respectively. The time required makes closure-by-removal untenable within the CCR Rule. Additionally, a suitable site for both the existing and current production CCR is not available within the SHF property; thus, removal to an offsite landfill was the only tenable option. The SHF property includes heavily vegetated areas, streams, and wetlands. Approximately 1395 acres of the SHF property are leased to the Kentucky Department of Wildlife. Much of the currently unused SHF property is also located within the floodplain. Other portions of SHF are occupied by transmission lines and are thus also unavailable for use as a landfill. Therefore, the environmental impacts associated with closure-by-removal of Ash Impoundment 2 and the former SWL to a location within SHF property would be higher than the impacts associated with closure-in-place. Closure-by-removal to a location within the existing SHF property would also still have a higher cost than closure-in-place, but no increase in overall impact to groundwater.

Comment 53: Moreover, TVA also did not include in its Closure-by-Removal analysis the economic benefit and cost savings associated with excavating CCRs and beneficially reusing that material in products that are sold. *See infra* Section 9. (*Commenter: Sierra Club*)

Response 53: TVA did not include these analyses because beneficial reuse is infeasible at SHF as explained in responses to Comments 40 through 42.

Comment 54: TVA and Stantec assumed that an on-site landfill of sufficient footprint and volume capacity cannot be constructed on land already owned by TVA—yet TVA already owns substantial land acreage capable of meeting TVA's 140-acre minimum footprint requirement (and considerably more) (see SHF property outline in DEIS at [page] 40): (*Commenter: Sierra Club*)

Response 54: See responses to Comments 44 and 52.

1.10 Other Disposal Areas

Comment 55: The DEIS improperly omits relevant information regarding all past, current, and proposed future waste disposal areas. As such, the DEIS does not properly evaluate the waste management process in compliance with the CCR Rule and NEPA.

TVA identified only two current or former disposal areas as subject to the U.S. Environmental Protection Agency's ("EPA") CCR Rule and as a focus of consideration in the DEIS: namely (1) Ash Impoundment 2, and the (2) Special Waste Landfill (alternatively referred to as the "SWL" or the "Consolidated Waste Dry Stack"). Crucially, however, there are in fact other former disposal areas that were not explicitly discussed in the DEIS and that TVA's proposed plan fails to consider, as the CCR Rule and NEPA, at least, require.

TVA fails to discuss one former disposal areas located on-site: the AFBC Fly Ash Disposal Area located southeast of rail loop, depicted by TVA below and highlighted in red in Graphic 15. The DEIS does not show or explain if that disposal area has ever been properly closed consistent with the closure performance standards in the CCR Rule or any KDWM standard. Stantec identified that disposal area in its "History of Construction" document that it prepared for Ash Pond 2. See Stantec 2017a, Appendix B.

The soil data investigation presented by TVA in the DEIS appears to confirm the presence of widespread wastes in the AFBC Fly Ash Disposal Area. TVA's use of the NRCS Soil Data Mapper in the DEIS identified soil types at and near the proposed Shawnee East Site landfill. During its review, TVA identified a soil type called "dump" in the area northwest of the site, as illustrated in red in Graphic 16, below, and from within Table 3.4-1 in the DEIS:

I performed a similar NRCS analysis on the above area identified by TVA as being a "dump," in addition to another TVA-owned area northwest of that area called the "rail loop" area. That analysis, as illustrated in the figures below in Graphic 17, suggests that TVA also disposed of unspecified CCR wastes into that rail loop area, which indicates that a second undisclosed disposal area exists.

TVA failed in the DEIS to identify, and thus to confront the relevance of, either the AFBC Fly Ash or the rail loop area as being past disposal sites. TVA should have included a discussion of both the AFBC Fly Ash Disposal Area and the rail loop areas (and any other disposal areas that may not yet have been disclosed), including how TVA plans to properly close all of those former disposal area. (*Commenter: Sierra Club*)

Response 55: The AFBC Fly Ash Disposal Area includes disposed ash and spent bed material as generated by the operation of the Atmospheric Fluidized Bed Combustion (AFBC) Pilot Plant. Disposal began in 1982 and was terminated in 1987. Authorization for closure of this disposal area was issued in 1999. This area was closed and capped with 6-inches of compacted clay and 20-inches of vegetative topsoil in accordance with the October 2, 1994 Closure Plans by Solutions to Environmental Problems, Inc. TVA monitors and maintains this closed disposal area. No further closure activities are required. This area is outside the scope of this EIS.

The NRCS Web Soil Mapper has mapped the entire SHF property, including the “Rail Loop Area” as "dump". This is because of the nature of the use of the property and does not mean the entire property is covered in coal waste. The rail loop area is a stormwater detention pond and is not an ash impoundment or disposal area and does not contain CCR.

Comment 56: TVA’s plan for closure of the SWL and Ash Impoundment 2, as laid out in the DEIS, differs in comparison to what TVA illustrated on its publicly available CCR Rule website. On its CCR Rule website, TVA considered the Dredge Cell as part of the SWL, rather than being a part of Ash Impoundment 2 as illustrated in the DEIS (see green area in Graphic 14, on the following page).

The Dredge Cell that TVA constructed in 1983 with dikes made of ash is prone to failure and unstable conditions. The Dredge Cell contains a significant amount of wastes (750,000 cubic yards). See Stantec 2016a at Appendix B. As one example of that instability, the dike built of ash failed in 1984 and created a “wave” of water that destroyed the water risers in the adjacent Stilling Pond. See Stantec 2016a at Appendix B. TVA did not specifically identify the unstable conditions in the DEIS or how it intends to remedy these conditions during closure. (*Commenter: Sierra Club*)

Response 56: TVA’s CCR Rule website (https://www.tva.gov/Environment/Environmental-Stewardship/Coal-Combustion-Residuals/Shawnee) depicts the CCR units as they are categorized under the CCR Rule (Figure A below). Figure 1.1-2 of the Draft EIS (Figure B below) depicted SHF Ash Impoundment 2 and the former SWL as defined in the *Shawnee Fossil Plant SWL and Ash Impoundment 2 Final Closure Projects Project Planning Document* (PPD; Stantec 2016a). The PPD was completed prior to finalization of the CCR Rule.

The existing onsite landfill, formerly the Special Waste Landfill (SWL), had a state landfill permit. However, it is now considered is a CCR Landfill under a Registered Permit-by-Rule with the Kentucky Division of Waste Management (KDWM) effective September 21, 2017. Although Ash Impoundment 2 still maintains an operating permit in accordance with the Kentucky Division of Water Kentucky Pollutant Discharge Elimination System (KPDES) Permit No. KY0004219, it also was transitioned to a Registered Permit-by-Rule under Kentucky’s CCR Rule on September 21, 2017. In the Draft EIS released on June

8, 2017, the onsite landfill was called the SWL. For consistency with the Draft EIS the onsite landfill is referred to in the Final EIS as the former SWL.

Figure 1.1-2 of the Final EIS has been updated to better describe the current classifications of Ash Impoundment 2 and the former SWL. This figure revision is provided for clarification, the associated analysis of impacts is unaffected by this change.

The dredge cell is located both within the original boundaries of Ash Impoundment 2 and within the permitted footprint of the former SWL landfill. Figure A shows the units as categorized by TVA per the CCR Rule and as shown on TVA's CCR Rule website. Ash Impoundment 2 and the former SWL, including the dredge cell, would be closed-in-place in accordance with the CCR Rule and

TVA would perform all demonstrations in accordance with the CCR Rule, including the unstable areas demonstration which is not due until October 2018. The demonstrations will be posted once complete.

Figure A. Map from Shawnee Coal Combustion Residuals website
(https://www.tva.gov/Environment/Environmental-Stewardship/Coal-Combustion-Residuals/Shawnee)

Figure B. Figure 1.1-2 from the Draft EIS.

1.11 Miscellaneous Comments

Comment 57: According to the DEIS, SHF is expected to produce approximately 490,000 to 910,000 cubic yards of CCR per year until 2040. However, it is unclear why the future volume of CCR is expected to significantly increase from 183,000 cubic yards of CCR annually to approximately 490,000 to 910,000 cubic yards. It is also unclear when the expanded CCR volumes will take effect and when the expanded rate of CCR production will start. In addition, Section 1.7 states that depending on the results of legislation in Kentucky, TVA may need either a Registered Permit-by-Rule, or a CCR Landfill Permit from the Kentucky Division of Waste Management. Recommendation: The EPA recommends that TVA explain why the future volume of CCR is expected to significantly increase. It would also be helpful to include a timeline depicting when the expanded CCR volumes will take effect and when the expanded rate of CCR production will start. In addition, EPA recommends that TVA discuss the permit issue in greater detail in the FEIS. (*Commenter: EPA*)

Response 57: In October 2017, the scrubber systems on SHF Units 1 and 4 became operational. This increased the estimated CCR output to approximately 490,000 cubic yards per year. The estimated increase in CCR production from 490,000 to 910,000 cubic yards is a conservative assumption of maximum generation that factors all nine SHF units running. This estimate assumes that scrubber systems are installed on Units 2 and 3 and 5 through 9. Scrubber systems are anticipated to begin operation on Units 1 and 4 in fall 2017. At present SHF does not anticipate installation of scrubber systems on the other 5 units (Units 2, 3 and 5-9). Therefore, this “significant increase” is the result of the conservative maximum estimate on the amounts of waste that could be produced in the future, which is the best course for assessing environmental impacts in a NEPA document.

The State of Kentucky recently approved management of both the former SWL and Ash Impoundment 2 under the state CCR program. Each was issued a Registered Permit-by-Rule, and now fall under 401 KAR 46. This issue is discussed in greater detail in Section 1.7.

Comment 58: TVA states that the current CCR waste generation rate is 183,000 cubic yards per year; the current SWL has enough capacity to last another 10 years (to 2027); and the proposed new landfill would provide capacity for another 20 to 25 years past that (to 2047 or 2052). See DEIS at 161. TVA estimated that the future waste generation rate will increase to 490,000 to 910,000 cubic yards to the year 2040. See id. at 22. That generation rate results in increases of 200 to 400% compared to the current generation rate. TVA’s statement in the DEIS regarding the life of the newly proposed landfill is contradictory. TVA claimed that the life is both 20 and 25 years; it is unclear which is correct. Compare id. at 1 with id. at 20. (*Commenter: Sierra Club*)

Response 58: See response to Comment 57. The expected lifetime of the new landfill is 20 years and this has been updated throughout the Final EIS.

Comment 59: TVA stated that, during completion of a 2015 New Landfill Siting Study, “new information regarding the seismic conditions of the area and the stability requirements since the original permitting prompted TVA to impose a capacity limit to be disposed of in the SWL.” DEIS At 9. TVA did not elaborate on what that “new information” was, yet should have included that information in the DEIS. Clearly, this new revelation suggests that the SWL (i.e., Ash Impoundment 1) disposal site is characteristically unstable for unspecified reasons. (*Commenter: Sierra Club*)

Response 59: During development of the PPD for closure of Ash Impoundment 2 and the Special Waste Landfill, TVA updated its siting evaluation in compliance with the new location restriction requirements associated with the CCR Rule. Based on the updated evaluation, TVA imposed a restriction on further stacking of ash as a seismic risk reduction measure; however, neither Ash Impoundment 2 nor the former SWL is unstable.

Comment 60: Meanwhile, TVA’s plan for closure of Ash Impoundment 2 includes construction of a new Equalization Basin that would receive wastewaters from the Shawnee Plant. See DEIS at 28, 31, and 38. However, TVA did not include any pertinent details—such as design parameters, operation, treatment capabilities, location, orientation relative to impoundments, etc.—about this wastewater treatment area. Given its significance as an integral part of TVA’s closure and continued landfill operations plan, TVA should have included details in the DEIS such as:

1. Reuse of on-site wastewaters for a zero discharge rather than constructing a new basin.
2. Discharging wastewater to the local publicly owned wastewater treatment facility.
3. Where the basin will be constructed.
4. How the basin will be constructed to protect groundwater.
5. What treatment mechanism will be used to treat the water to remove constituents of concern. (*Commenter: Sierra Club*)

    Response 60: The term "Equalization Basin" used in the Draft EIS has been changed to "Process Water Basin(s)" in the Final EIS to better describe its purpose. Additional details regarding the Process Water Basin(s) have been added to Subsection 2. 2.2 of the Final EIS. If needed, the Process Water Basin(s) at SHF will be further evaluated under a separate NEPA analysis.

Comment 61: We noticed a statement on pages 112 and 117 that is inconsistent with our coordination with TVA on this project. The Draft EIS identifies 33 acres of forested habitat suitable for the Indiana bat and northern long-eared bat on the Shawnee East site that would be impacted by Alternative B. In correspondence with the Service, TVA has identified 68.4 acres of bat habitat at this site that would be impacted by the proposed project. This total acreage is documented in an April 4, 2017 email from Mr. Liz Hamrick of TVA. (*Commenter: United States Fish and Wildlife Service*)

Response 61: The acreage of bat habitat that would be impacted by the proposed project was misreported in the Draft EIS. A total of 68.4 acres of bat habitat would be impacted by the proposed project. The acreage of bat habitat impacted by the proposed project has been updated from 33 acres to 68.4 acres in the Final EIS.

Comment 62: From our review of the DEIS, it appears that the entire forested area for the new CCR Landfill is proposed to be clear-cut. This clear-cutting is expected to extend well beyond the actual areas needed for the new CCR Landfill and access roads. <u>Recommendation:</u> TVA should consider reducing the clear-cut area and the design and construction should include a mature vegetative buffer around the proposed CCR Landfill as a natural screen and noise buffer. This practice would also potentially reduce construction costs for clearing and re-planting efforts. (*Commenter: EPA*)

Response 62: Under Alternative B, TVA would leave any mature trees in place around the boundaries of the proposed new landfill. TVA would clear all trees inside the project area. The majority of impacted trees are located inside the project area and not along the project boundaries (see Figure 2.1-6). TVA would plant a vegetative barrier around the site as shown in Figure 2.1-6 to minimize potential visual and noise impacts.

Comment 63: Check truck route for overpasses & low hanging areas. Also, check narrow road widths. (*Commenter: Ruby English*)

Response 63: TVA reevaluated the potential route for hauling CCR to an offsite landfill. Figure 2.1-7 shows the new proposed route. The primary changes are the roads between SHF and the interstate. TVA drove this portion of the route to ensure overpasses, low hanging areas, and road widths were all appropriate for the types of trucks anticipated to be used. TVA reevaluated the impacts analysis associated with the offsite transportation route. Changing the route did not change any of the impact conclusions.

Comment 64: The DEIS does not contain details regarding the potential requirement for a Title V air permit. <u>Recommendations:</u> The TVA should clarify and evaluate the proposed actions that may be necessary to determine if a modification to the current air permit is required in the FEIS. The TVA might also take into consideration the nearby Paducah Gaseous Diffusion Plant and the cumulative air emission impacts in the FEIS. The FEIS should include a timeframe for "temporary impacts" as it relates to fugitive dust and CCR emissions and what mitigation measures are included in best management practices to reduce the potential impacts to downwind residents and communities. (*Commenter: EPA*)

Response 64: In the State of Kentucky, facilities holding a Title V permit are required to modify that permit for construction activities. TVA has analyzed Title V permit requirements and is coordinating with the State of Kentucky for a Title V modification in association with the proposed closure activities and construction of the new CCR landfill. Subsection 3.1.2.2.2 has been updated to clarify the Title V permit modification and duration of temporary impacts.

Cumulative air quality impacts associated with activities at the Paducah Gaseous Diffusion Plant are considered in Subsection 3.25.2.1. The “temporary impacts” would occur during the period in which both the PGDP is engaged in remediation activities that involve soil moving and potential dust mobilization and periods in which SHF is engaged in closure activities. Subsection 3.25.2.1 has been updated to clarify that these temporary impacts would be intermittent over time.

Potential mitigation measures to minimize these cumulative impacts would be the same as the mitigation measures described in Section 3.1.2.2.2 including moisture conditioning, compaction, mulch, wind breaks/barriers, tillage, and stones as permitted.

Comment 65: The third option seems the best for the environment. Why would the dry ash stay in place or would it go directly into the land fill? The land fill would best be on site. How will it not bleed into the groundwater eventually? (*Commenter: Jo Tilley Dortch*)

Response 65: TVA's preferred alternative is Alternative B - Construction of Onsite Landfill and Closure of Existing Landfill and Ash Impoundment 2. Under Alternative B, the existing Ash Impoundment 2 and Special Waste Landfill would be closed-in-place. Material may be consolidated from one part of Ash Impoundment 2 into other parts of the same impoundment. The remainder of the ash in both Ash Impoundment 2 and the Special Waste Landfill would remain in place. Ash Impoundment 2 and the Special

Waste Landfill would be closed in accordance with the CCR Rule. Also under Alternative B, a new onsite landfill would be constructed at the Shawnee East Site, within the SHF property. Dry CCR produced at SHF would be disposed of in this new landfill. The new landfill would meet the requirements for a CCR landfill in the State of Kentucky and the EPA CCR Rule which would be protective of groundwater. These requirements include a liner and leachate collection system which is used by the industry to mitigate potential groundwater impacts.

Comment 66: I hope, this time [the upcoming Draft EIS public meeting] TVA will send knowledgeable people that can answer the land owners' questions surrounding Shawnee Fossil Plant. … So send someone that can answer our question. All the answers we got last time, was "I DON'T KNOW. The 7 people TVA sent last time could not explain the 5 or 6 maps that was displayed on February. (*Commenter: Phyllis Robertson*)

Response 66: TVA staff at the scoping meeting were prepared to answer all questions related to the current proposed actions. However, the initiation of project activities was undetermined at the time of the scoping meeting because the project schedule is based on the completion of all appropriate environmental reviews, project design decisions, and TVA decision-making. TVA staff explained this situation at the scoping meeting and in the scoping report included in the DEIS. TVA staff at the DEIS public meeting were able to discuss the completed environmental reviews, more advanced project designs, the maps, and the TVA decision-making process. The responses to comments received during the scoping meeting and the scoping materials including the maps presented at the meeting are included in Appendix A of the EIS.

Comment 67: What is TVA/Shawnee's intended purpose of the land (approximately 350 acres South of Gipson Rd to South of Anderson Rd and West of Metropolis Lake Road) that was purchased last year? TVA should provide detailed Maps showing what TVA will do with this land and how the landowners will be affected. (*Commenter: Phyllis Robertson*)

Response 67: Detailed maps showing the proposed project area, including portions of the property that were purchased last year, are included in the DEIS and were available for review at the public meeting. See Figure 2.1-6 of the Draft and Final EIS.

Comment 68: When will Shawnee start stripping the dirt from the proposed new landfill area? When will Shawnee will start dumping Fly Ash on the new landfill site? (*Commenter: Phyllis Robertson*)

Response 68: Under Alternative B, TVA anticipates beginning the excavation of dirt from the Shawnee East Site in January 2018. Additionally, TVA anticipates April 2019 for the first waste disposal at the proposed Shawnee East landfill site.

Comment 69: The DEIS improperly relies upon the Programmatic EIS ("PEIS") and its Electric Power Research Institute ("EPRI") Framework Model to support Closure-in-Place of the Special

Waste Landfill and Ash Impoundment 2. The EPRI Framework Model, which the PEIS in turn relied upon, is flawed and should not have been invoked for the Shawnee site.

TVA incorporates its PEIS (see TVA 2016) as a basis for closing surface impoundments in the more recent SHF DEIS, stating that “a portion of this EIS is intended to tier from the 2016 PEIS to evaluate closure alternatives for the Ash Impoundment 2 and analyze the impacts of closure of the SWL.” DEIS at [page] 3. TVA accordingly relied upon the technical components of the PEIS in the current DEIS.

The PEIS, in turn, relied upon EPRI and its use of the Relative Impact Framework environmental impact model. That EPRI model did not use actual site-specific Shawnee site conditions but rather assumed generic site conditions to a hypothetical surface impoundment to select the Closure-in-Place alternative as TVA’s preferred system-wide closure approach.

For example, EPRI’s flawed assumption in the Framework Model that arsenic is a “low mobility” CCR constituent that is more slowly transported in water (see TVA 2016, at 34) does not consider that arsenic and other metals can have a high solubility and transport rate under a variety of pH conditions. As such, EPRI’s assumption is not universally correct, and their model under-predicts the possible impacts at/near Shawnee associated with some CCR constituents.

In conclusion, the EPRI Framework Model—and hence the PEIS that relied on it—does not support TVA’s selection of the Closure-in-Place alternative because it fails to use site-specific information to properly quantify alleged groundwater improvements by concentration or duration in groundwater or surface water, as one example. (*Commenter: Sierra Club*)

> **Response 69:** The EPRI model did not use SHF-specific conditions. It was used to establish hypothetical conditions for the PEIS. The current SHF Draft and Final EIS evaluate SHF specific conditions. Section 2.1.3.2 discusses the EPRI model applicability and verification in the PEIS.
>
> The EPRI modeling evaluated *relative* changes in concentration, under specific conditions between two closure scenarios (closure-in-place and closure-by-removal). Source concentrations and resulting modeled concentrations in groundwater, were compared to determine the ratio between closure-in-place and closure-by-removal at specific locations and specific points in time. The EPRI modeling did not evaluate *absolute* concentrations relative to human health or ecological risk associated with specific constituents at specific concentrations. To that end, arsenic was used to represent any constituents where sorption may occur during migration in groundwater. This is discussed briefly in TVA application report (3002007542) Table 2-2 where arsenic was listed as an example of a low mobility constituent by using parentheses around the wording: “low mobility (e.g., As).”
>
> The constituent-specific parameters used in the EPRI modeling were the same for both the closure-in-place and closure-by-removal scenarios. For any given constituent (low mobility or high mobility), only the rate of release and period of release differed between

closure scenarios. As a result, if a parameter caused under-prediction (or over-prediction) of concentration for one closure scenario, then it had the same effect on the other closure scenario. Because all other groundwater and surface water inputs were the same for the two closure scenarios, the EPRI evaluation of relative impact for groundwater and surface water in the TVA application was only dependent on the differences in rate of release and period of release modeled for the two closure scenarios.

SHF site specific analysis is presented in Chapter 3 of the Draft and Final EIS. This site specific analysis forms the basis for TVA's decision making process for the section of Alternative B as the preferred alternative for the current proposed action.

Comment 70: The United States Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement by the Tennessee Valley Authority for the Shawnee Fossil Plant Coal Combustion Residual Management. We offer no comments at this time. (*Commenter: United States Department of the Interior*)

Response 70: Comment noted.

Comment 71: No Comment [from the Compliance and Technical Assistance Branch] (*Commenter: Kentucky Clearinghouse/Kentucky Department for Environmental Protection*)

Response 71: Comment noted.

Comment 72: The Division of Enforcement does not object to the project proposed by the applicant. (*Commenter: Kentucky Clearinghouse/Kentucky Department for Environmental Protection*)

Response 72: Comment noted.

Comment 73: Utility line projects that cross a stream will require a Section 404 permit from the US Army Corps of Engineers and a 401 Water Quality Certification from DOW. (*Commenter: Kentucky Clearinghouse/Kentucky Department for Environmental Protection*)

Response 73: Comment noted. TVA will obtain a permit from the US Army Corps of Engineers and a 401 Water Quality Certification from the Division of Water prior to any stream crossing construction.

Comment 74: The Kentucky Division of Water supports the goals of EPA's Sustainable Infrastructure Initiative. This Initiative seeks to promote sustainable practices that will help to reduce the potential gap between funding needs and spending at the local and national level. The Sustainable Infrastructure Initiative will guide our efforts in changing how Kentucky views, values, manages, and invests in its water infrastructure. This website, www.epa.gov/waterinfrastructure/, contains information that will help you ensure your facility and operations are consistent with and can benefit from the aims of the Sustainable

Infrastructure Initiative. (*Commenter: Kentucky Clearinghouse/Kentucky Department for Environmental Protection*)

Response 74: Comment noted.

Comment 75: DOW CTAB has no negative comments. Permitting concerns have been addressed in comments by other DOW branches. (*Commenter: Kentucky Clearinghouse/Division of Water*)

Response 75: Comment noted.

Comment 76: Based on the information provided, the Kentucky Department of Fish & Wildlife Resources has no comments concerning the proposed project. (*Commenter: Kentucky Clearinghouse/Kentucky Department of Fish and Wildlife*)

Response 76: Comment noted.

Comment 77: The Department of Housing Buildings and Construction, Division of Building Code Enforcement has no comments concerning the proposed project. (*Commenter: Kentucky Clearinghouse/Housing and Building Construction*)

Response 77: Comment noted.

Comment 78: The Kentucky Transportation Cabinet is responsible for controlling both public and private usage of right-of-way of the State road system. Any firm, individual, or government agency desiring access to a State road or desiring to perform any type of work (including signage, boring, etc.) on or adjacent to State right-of-way must obtain a permit from the Department. Any proposed access or encroachment of a State maintained road right-of- way should be coordinated at the earliest stage with:

Tom Hines, P.E. Permits Engineer
Kentucky Department of Highways, District 1
5501 Kentucky Dam Road, Paducah, Kentucky 42003
Telephone: (270) 898-2431 or 1 (800) 338-4283, Fax: (270) 898-7457 (*Commenter: Kentucky Clearinghouse/Kentucky Transportation Cabinet (CO)*)

Response 78: Comment noted. TVA will coordinate with the Kentucky Department of Highways in the event of any anticipated work with a roadway or right-of-way.

Comment 79: To receive a review from the KY Heritage Council/State Historical Preservation Office (SHPO) you must follow the instructions located on their website at http://www.heritage.ky.gov/siteprotect/. There you will find the required documents for the Section 106 Review and Compliance for 36 CFR Part 800. This Section 106 submission process to SHPO will assist applicants and agencies in providing the appropriate level of information to receive comments from SHPO. (*Commenter: Kentucky Clearinghouse/Kentucky Heritage Council*)

Response 79: Comment noted. TVA has conducted a Section 106 review in consultation with the KY SHPO as discussed in Section 3.18 of the EIS.

Comment 80: No Comment [from the Purchase Area Development District]. (*Commenter: Kentucky Clearinghouse/Purchase Area Development District*)

Response 80: Comment noted.

1.12 Out of Scope Comments

Comment 81: Honestly, I favored shutting this plant down. Nuclear and fossil fuels will be done in the near future. Here, geothermal technology seems the best fit. Green energy is becoming less expensive, less a target for terrorism and more sustainable. Go for the green instead of trying to bandaid a dying alternative. (*Commenter: Jo Tilley Dortch*)

Response 81: Your comment is noted; however, this EIS concerns the management of CCR disposal at SHF, not whether SHF should continue to operate or not. In 2015, TVA issued an update to its Integrated Resource Plan (IRP) which provides strategic guidance on the energy resource mix that will best respond to changing market conditions. The IRP's preferred alternative, the Target Power Supply Mix, called for set ranges for an appropriate power supply mix, and, although it recommended the closure of several coal fired power plants, it recommended that SHF be operated until at least the 2020s.

Comment 82: Have more detail maps about this Anhydrous Ammonia tank farm that is to be West of coal pile. I understand from worker at the plant. That if there is a release of Anhydrous Ammonia that a 5 mile evacuation will be in forced. (*Commenter: Phyllis Robertson*)

Response 82: The use of the anhydrous ammonia issue was addressed in TVA's 2014 *Shawnee Fossil Plant Units 1 and 4 Final Environmental Assessment* which assessed potential environmental impacts involved with installing selective catalytic reduction and flue gas desulfurization systems on Shawnee Units 1 and 4 in order to reduce nitrogen oxide and sulfur dioxide emissions from those units. Potential impacts to the environment and safety mitigation measures were assessed in that document and are outside the scope of this EIS. The 2014 EA can be found at: https://www.tva.gov/file_source/TVA/Site%20Content/Environment/Environmental%20Stewardship/Environmental%20Reviews/Shawnee%20Fossil%20Plant%20Units%201%20and%204/Shawnee%20U1-4%20FEA.pdf.

Comment 83: Who can we contact to get someone to bush hog all this tall Johnson Grass? When it was farmed it was keep nice looking. Now it's an eye sore and we ready have to watch close for wild life running out in front of our cars. (*Commenter: Phyllis Robertson*)

Response 83: TVA bush hogs the Shawnee East Site every six weeks.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
330 West Broadway, Suite 265
Frankfort, Kentucky 40601
(502) 695-0468

July 7, 2017

Ms. Ashley Pilakowski
NEPA Compliance Specialist
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902-1499

Re: FWS 2017-B-0057; Tennessee Valley Authority (TVA); Shawnee Fossil Plant Coal Combustion Residual Management, Draft Environmental Impact Statement; McCracken County, Kentucky

Dear Ms. Pilakowski:

Thank you for the opportunity to review the Draft Environmental Impact Statement (Draft EIS) for the above-referenced project. The U.S. Fish and Wildlife Service (Service) has reviewed this document and offers the following comments in accordance with the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.).

61 We noticed a statement on pages 112 and 117 that is inconsistent with our coordination with TVA on this project. The Draft EIS identify 33 acres of forested habitat suitable for the Indiana bat and northern long-eared bat on the Shawnee East site that would be impacted by Alternative B. In correspondence with the Service, TVA has identified 68.4 acres of bat habitat at this site that would be impacted by the proposed project. This total acreage is documented in an April 4, 2017 email from Mr. Liz Hamrick of TVA.

Thank you again for your request. Your concern for the protection of endangered and threatened species is greatly appreciated. If you have any questions regarding the information that we have provided, please contact Jessica Blackwood Miller at (502) 695-0468 extension 104 or jessica_miller@fws.gov.

Sincerely,

Virgil Lee Andrews, Jr.

Virgil Lee Andrews, Jr.
Field Supervisor

Name: jo tilley dortch

Comments: The third option seems the best for the environment. Why would the dry ash stay in place or
65 would it go directly into the land fill? The land fill would best be on site. How will it not bleed
into the groundwater eventually? Honestly, I favored shutting this plant down. Nuclear and
81 fossil fuels will be done in the near future. Here, geothermal technology seems the best fit.
Green energy is becoming less expensive, less a target for terrorism and more sustainable. Go
for the green instead of trying to bandaid a dying alternative.

close window

From: phyllis Robertson
To: Pilakowski, Ashley Anne
Cc: jrcflyforjesus@brtc.net; bpendergrass@ymail.com
Subject: EIS and CCR land fill at Shawnee Fossil Plant.
Date: Monday, June 12, 2017 1:09:44 PM

TVA External Message. Please use caution when opening.

Ashley A. Pilakowski.

66 I hope, this time TVA will send knowledgeable people that can answer the land owners questions surrounding Shawnee Fossil Plant.

82 Have more detail maps about this Anhydrous Ammonia tank farm that is to be West of coal pile. I understand from worker at the plant. That if there is a release of Anhydrous Ammonia that a 5 mile evacuation will be in forced.

67 We all want to know what TVA/Shawnee intended purpose of the land that was purchased last year. Approximately 350 acres South of Gipson Rd to South of Anderson Rd and West of Metropolis Lake Road. Detailed Maps showing what TVA will do with this land and how the landowners will be effected.

68 When will Shawnee will start stripped the dirt from this area? When Shawnee will start dumping Fly Ash on the area?

83 Who can we contact to get someone to bush hog all this tall Johnson Grass? When it was farmed it was keep nice looking. Now it's an eye sore and we ready have to watch close for wild life running out in front of our cars.

This is just a few of the question that will be ask on June 22, 2017.

66 So send someone that can answer our question. All the answers we got last time, was "I DON'T KNOW. The 7 people TVA sent last time could not explain the 5 or 6 maps that was displayed on February.

Phyllis Robertson
8935 Gipson RD
West Paducah, KY. 42086
270-488-3703

Public Meeting Comment Form

Shawnee Fossil Plant Coal Combustion Residual Management Project
Environmental Impact Statement (EIS)

We want your comments! If you have any issues, concerns, or questions related to the Shawnee Fossil Plant Coal Combustion Residual Management Draft Environmental Impact Statement (EIS), please complete and submit this comment sheet at the public meeting to ensure your input is considered. You can also drop the comment sheet in the mail to the address on the reverse side of this sheet. Fold the comment sheet on the lines with the return address showing, tape it closed, affix a stamp, and mail. You may attach additional pages. Please submit your comments by ***July 31, 2017***.
You may also submit comments by e-mail to Ashley Pilakowski, aapilakowski@tva.gov.

For your comments to be the most effective, TVA suggests the following guidelines:

- Keep your comments focused on the proposed project;
- Submit your comments on potential impacts and project alternatives; and
- Submit your comments within the timeframes announced.

If you have no comments or questions, but would like to be on our mailing list and receive a copy of the Final EIS, please complete the contact information below.

63 1. Check truck route for overpasses & low hanging areas. Also, check narrow road widths.

Please provide your contact information. If you would like to receive copies of the Final EIS, please fill in the box on the reverse side and submit this form.

Before including your address, phone number, e-mail address or any other personally identifying information in your comment, you should be aware that your entire comment – including personal identifying information - may be made publicly available at any time. While you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Name: Ruby English Title:
Organization:
Mailing address:
City, State, Zipcode:
E-mail: renglish@internet Phone: 270-488-3225

Thank you for your interest and participation!

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

JUL 31 2017

Ms. Ashley Pilakowski
NEPA Compliance Specialist
Tennessee Valley Authority
400 West Summit Hill Dr., WT 11 D
Knoxville, Tennessee 37902-1499

Re: Draft Environmental Impact Statement for Shawnee Fossil Plant Coal Combustion Residual Management, McCracken County, Kentucky; CEQ No: 20170102.

Dear Ms. Pilakowski:

The U. S. Environmental Protection Agency has reviewed the referenced document in accordance with Section 309 of the Clean Air Act and Section 102(2)(C) of the National Environmental Policy Act (NEPA). The purpose of this Draft Environmental Impact Statement (DEIS) is to support the Tennessee Valley Authority's (TVA's) goal to eliminate wet storage of Coal Combustion Residuals (CCR) at the Shawnee Fossil Plant (SHF), provide additional dry CCR material storage, and assist TVA in meeting new CCR regulations. The plant is located in McCracken County, Kentucky, on the south bank of the Ohio River, about 13 miles northwest of Paducah.

SHF has nine active coal-fired generating units constructed between 1951 and 1957. A 10th unit was retired in 2014. Currently, SHF consumes an average of 2.7 million cubic yards of coal per year which results in approximately 183,000 cubic yards of CCR annually. The coal ash is stored in both an existing Special Waste Landfill (SWL) and Ash Impoundment 2. Ash impoundment 2 would be closed under either of the action alternatives. The estimated remaining capacity for the SWL is approximately 5.2 million cubic yards. Due to current and projected SHF operations, it is expected that the existing landfill will reach capacity by 2027. To accommodate the need for additional dry CCR storage at SHF, TVA is proposing to design, build and operate a new CCR Landfill that would accommodate up to 20 additional years of storage capacity. Based on the DEIS, SHF is also expected to produce approximately 490,000 to 910,000 cubic yards of CCR per year until year 2040.

The EPA has reviewed the DEIS and the three alternatives for disposal of CCR generated at SHF. The alternatives include the no action alternative (Alternative A) and two action alternatives (Alternative B and Alternative C). Under Alternative B, TVA would close Ash Impoundment 2 in-place by reducing its footprint, close the SWL in-place and build and operate a new CCR Landfill on a portion of the original Option 1 site known as the Shawnee East Site. Under Alternative C, TVA would close Ash Impoundment 2 in-place by reducing its footprint, close the SWL in-place, and transport dry CCR produced by daily operations at SHF to the Freedom Waste Landfill, in Mayfield, Kentucky (approximately 32 miles from SHF) on public roadways. TVA has identified Alternative B as their preferred alternative. The DEIS indicates that this option achieves both the purpose and need of the project and avoids offsite transfer of CCR along public roads, thus eliminating long-term air emission impacts.

3 Based on our review, the EPA rated the DEIS as "EC-2"– or Environmental Concerns with additional information requested. The EPA identified environmental concerns associated with the proposed action and enclosed detailed technical comments and recommendations for your consideration (See enclosure). The EPA's environmental concerns primarily relate to the long-term protection of water quality and fugitive dust emissions from SHF CCR operations. We recommend that the TVA adhere to federal and state permitting requirements related to water quality and necessary permits as well as best management practices that have been identified in the DEIS.

The EPA appreciates the opportunity to review the SHF Landfill DEIS. If you wish to discuss this matter further, please contact Mr. Larry O. Gissentanna of the NEPA Program Office at (404) 562-8248 or by e-mail at gissentanna.larry@epa.gov.

Sincerely,

Alan Farmer

G. Alan Farmer
Director
Resource Conservation and Restoration Division

Enclosure

Enclosure
EPA Comments on the Draft Environmental Impact Statement (DEIS)
Shawnee Fossil Plant Coal Combustion Residual Management, McCracken County, Kentucky;
CEQ No: 20170102

4 **Timing of Proposed Action-** Tennessee Valley Authority (TVA) identified the need for additional long-term storage of dry Coal Combustion Residuals (CCR) materials produced at SHF, as well as closing the existing wet storage impoundment and Special Waste Landfill (SWL). Recommendation: The Final Environmental Impact Statement (FEIS) should include a discussion or timetable on when the anticipated construction will begin on the Shawnee Fossil Plant (SHF) Bottom Ash Process Dewatering Facility because the current onsite SWL is expected to reach capacity by 2027.

24 **Water Resources-** In Section 2.4 of the DEIS, general statements concerning wetlands and/or stream crossings and stream alterations are provided. The DEIS does not detail what type of crossing and or stream alterations would be subject to requirements outlined in a Clean Water Act Section 404 permit or what impacts to jurisdictional waters are anticipated. TVA also provided general information in the DEIS about the General Storm Water Construction Permit for this project. In addition, Section 1.7 of the DEIS indicates that TVA will evaluate the proposed actions to determine if a modification to the Kentucky Pollutant Discharge Elimination System permit or notification to Kentucky Department of Environmental Protection will be required due to potential alteration of the wastewater stream(s). Recommendations: The EPA recommends further information in the FEIS regarding potential permitting requirements and jurisdictional stream and wetland impacts associated with the new landfill and other facilities. The EPA also recommends that the FEIS include more detail concerning how additional stormwater from the new landfill would be addressed in order to ensure future compliance with state and federal requirements and how wastewater generated from the dewatering or decanting process and seeps will be addressed.

64 **Air Quality-** The DEIS does not contain details regarding the potential requirement for a Title V air permit. Recommendations: The TVA should clarify and evaluate the proposed actions that may be necessary to determine if a modification to the current air permit is required in the FEIS. The TVA might also take into consideration the nearby Paducah Gaseous Diffusion Plant and the cumulative air emission impacts in the FEIS. The FEIS should include a timeframe for "temporary impacts" as it relates to fugitive dust and CCR emissions and what mitigation measures are included in best management practices to reduce the potential impacts to downwind residents and communities.

57 **Waste-** According to the DEIS, SHF is expected to produce approximately 490,000 to 910,000 cubic yards of CCR per year until year 2040. However, it is unclear why the future volume of CCR is expected to significantly increase from 183,000 cubic yards of CCR annually to approximately 490,000 to 910,000 cubic yards. It is also unclear when the expanded CCR volumes will take effect and when the expanded rate of CCR production will start. In addition, Section 1.7 states that depending on the results of legislation in Kentucky, TVA may need either a Registered Permit-by-Rule, or a CCR Landfill Permit from the Kentucky Division of Waste Management. Recommendation: The EPA recommends that TVA explain why the future volume of CCR is expected to significantly increase. It would also be helpful to include a timeline depicting when the expanded CCR volumes will take effect and when the expanded rate of CCR production will start. In addition, EPA recommends that TVA discuss the permit issue in greater detail in the FEIS.

42 **Beneficial use-** Section 3.20.1.4 of the DEIS mentions the types of beneficial uses of coal combustion solid waste. However, the analysis does not state how the TVA is currently using or will use coal ash in

"other products." <u>Recommendation</u>: The EPA requests that TVA provide additional discussion on the
42 TVA's intent to utilize or manage coal ash as a product. The FEIS should include a discussion about
how this beneficial use will/may extend the life expectancy of the newly proposed CCR Landfill.

Noise- From our review of the DEIS, it appears that the entire forested area for the new CCR Landfill is
proposed to be clear-cut. This clear-cutting is expected to extend well beyond the actual areas needed for
62 the new CCR Landfill and access roads. <u>Recommendation</u>: TVA should consider reducing the clear-cut
area and the design and construction should include a mature vegetative buffer around the proposed
CCR Landfill as a natural screen and noise buffer. This practice would also potentially reduce
construction costs for clearing and re-planting efforts.

MATTHEW G. BEVIN
GOVERNOR

DEPARTMENT FOR LOCAL GOVERNMENT
OFFICE OF THE GOVERNOR
1024 CAPITAL CENTER DRIVE, SUITE 340
FRANKFORT, KENTUCKY 40601-8204
PHONE (502) 573-2382   FAX (502) 573-2939
TOLL FREE (800) 346-5606/ TDD:711
WWW.kydlgweb.ky.gov

SANDRA K. DUNAHOO
COMMISSIONER

July 10, 2017

Mrs. Ashley Pilakowski
Tennessee Valley Authority
7900 Metropolis Lake Rd
Paducah, KY 42086

RE: Shawnee Fossil Plant's Coal Combustion Residual Management Draft Environmental Impact Statement
SAI# KY201706090756

Dear Mrs. Pilakowski:

The Kentucky State e-Clearinghouse is the official designated Single Point of Contact (SPOC) for the Commonwealth pursuant to Presidential Executive Order 12372, and supported by Kentucky Statutes KRS 45.03. The primary function of the SPOC is to streamline the review aforementioned process for the applicant and the funding agency. This process helps in vocalizing the statutory and regulatory requirements. Information in the form of comments, if any, will be attached to this correspondence.

This proposal has been reviewed by the appropriate state agencies in the e-Clearinghouse for conflicts with state or local plans, goals and objectives. After receiving this letter, you should make it available to the funding agency and continue with the funding agencies application process. This e-clearinghouse SPOC letter signifies only that the project has followed the state reviewing requirements, and is neither a commitment of funds from this agency or any other state or federal agency. Please remember if any federal reviews are required the applicant must follow through with those federal agencies.

The results of this review are valid for one year from the date of this letter. If the project is not submitted to the funding agency or not approved within one year after the completion of this review, the applicant can request an extension by email to Lee.Nalley@ky.gov. If the project changes in any way after the review, the applicant must reapply through the eclearinghouse for a new review. There are no exceptions.

If you have any questions regarding this letter or the review process please contact the e-Clearinghouse office at 502-573-2382, ext. 274.

Sincerely,

Lee Nalley

Lee Nalley, SPOC
Kentucky State Clearinghouse

Attachment

Updated Comments: KY Department for Environmental Protection
Ronald Price

This review is based upon the information that was provided by the applicant through the Clearinghouse for this project. An endorsement of this project does not satisfy, or imply, the acceptance or issuance of any permits, certifications, or approvals that may be required from this agency under Kentucky Revised Statutes or Kentucky Administrative Regulations. Such endorsement means this agency has found no major concerns from the review of the proposed project as presented other than those stated as conditions or comments.

19 The proposed project is subject to Division of Water (DOW) jurisdiction because the following are or appear to be involved: Environmental Impact Statement. Prior approval must be obtained from the DOW before construction can begin. The applicant must cite the State Application Identifier (SAI #KY201706090756) when submitting plans and specifications to the DOW.

The Tennessee Valley Authority (TVA) is seeking comment on a draft Environmental Impact Statement (EIS) to address the potential environmental effects associated with ceasing operations at the special waste landfill and Ash Impoundment 2, and building and operating a new dry coal combustion residual (CCR) landfill at the Shawnee Fossil Plant (SHF) located near Paducah, Kentucky in McCracken County. A public open house to discuss the Draft EIS is scheduled from 4:30-6:30 p.m. CST on Thursday, June 22, 2017 at the Robert Cherry Civic Center, 2701 Park Avenue, Paducah, Kentucky.

20 Little Bayou Creek and Bayou Creek traverse the western portion of the site. Little Bayou Creek is impaired for the warm water aquatic life use due to beta particles and photon emitters, copper, gross alpha, cause unknown, lead and polychlorinated biphenyls. Bayou creek is impaired for the warm water aquatic life use due to beta particles and photon emitters, copper, gross alpha, lead, mercury, nutrient/eutrophication biological indicators, and sedimentation/siltation. Metropolis Lake, to the east of the project area is an exceptional and outstanding state resource water. The Ohio River, just downstream of the site, is an outstanding state resource water due to the presence of federal threatened and endangered species. Andrea Fredenburg, Water Quality Branch, (502) 782-6950, Andrea.Fredenburg@ky.gov.

71 No comment. Sarah Gaddis, Compliance and Technical Assistance Branch, (502) 782-6953, Sarah.Gaddis@ky.gov.

72 The Division of Enforcement does not object to the project proposed by the applicant. Tim Harrod, Division of Enforcement, (502) 782-6858, Timothy.Harrod@ky.gov.

21 The proposed work is endorsed by the Groundwater Section of the Watershed Management Branch. However, it is our recommendation that site be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area with the proposed Groundwater Monitoring within the Environmental Impact Statement. Wei Ji, Watershed Management Branch, (502) 782-6934, Wei.Ji@ky.gov.

37 From the application data, the DOW ascertains that the proposed alternatives will not impact the 100 year floodplain. Julia Harrod, Watershed Management Branch, (502) 782-6967, Julia.Harrod@ky.gov.

22 If the construction area disturbed is equal to or greater than 1 acre, the applicant will need to apply for a Kentucky Pollutant Discharge Elimination System (KPDES) storm water discharge permit.

73 Utility line projects that cross a stream will require a Section 404 permit from the US Army Corps of Engineers and a 401 Water Quality Certification from DOW.

74 The Kentucky Division of Water supports the goals of EPA's Sustainable Infrastructure Initiative. This Initiative seeks to promote sustainable practices that will help to reduce the potential gap between funding needs and

74 spending at the local and national level. The Sustainable Infrastructure Initiative will guide our efforts in changing how Kentucky views, values, manages, and invests in its water infrastructure. This website, www.epa.gov/waterinfrastructure/, contains information that will help you ensure your facility and operations are consistent with and can benefit from the aims of the Sustainable Infrastructure Initiative.

23 The proposed COCs that will be analyzed for monitoring of groundwater, did not include PAH constituents. They proposed to primarily monitor for metals. PAH contamination could be a potential COC in fly ash from coal where it definitely is a COC concern.

Division of Enforcement
Tim Harrod

72 The Division of Enforcement does not object to the project proposed by the applicant.
Tim Harrod, Enforcement Specialist, Division of Enforcement, Timothy.Harrod@ky.gov

Division of Water
Andrea Fredenburg

20 Little Bayou Creek and Bayou Creek traverse the western portion of the site. Little Bayou Creek is impaired for the warm water aquatic life use due to beta particles and photon emitters, copper, gross alpha, cause unknown, lead and polychlorinated biphenyls. Bayou creek is impaired for the warm water aquatic life use due to beta particles and photon emitters, copper, gross alpha, lead, mercury, nutrient/eutrophication biological indicators, and sedimentation/siltation. Metropolis Lake, to the east of the project area is an exceptional and outstanding state resource water. The Ohio River, just downstream of the site, is an outstanding state resource water due to the presence of federal threatened and endangered species.

Division of Water
Julia Harrod

37 The proposed alternatives will not impact the 100 year floodplain.
No formal approval is required for Water Withdrawal Permitting or Water Management Planning.

DOW
Sarah Gaddis

75 DOW CTAB has no negative comments. Permitting concerns have been addressed in comments by other DOW branches.

DOW
Wei Ji

21 The proposed work is endorsed by the Groundwater Section of the Watershed Management Branch. However, it is our recommendation that site be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area with the proposed Groundwater Monitoring within the EIS. Questions should be directed to Wei Ji (502-782-6934) or the Section Supervisor David Jackson (502-782-6986).

Fish and Wildlife
Dan Stoelb

76 Based on the information provided, the Kentucky Department of Fish & Wildlife Resources has no comments concerning the proposed project. Please contact Dan Stoelb @ 502-564-7109 ex. 4453 or Daniel.Stoelb@ky.gov if you have further questions or require additional information.

Housing Building and Construction
Phil Craig

77 The Department of Housing Buildings and Construction, Division of Building Code Enforcement has no comments concerning the proposed project.

Kentucky Transportation Cabinet (CO)
Carolyn Weber
Jessica Herring (D-1) - Endorse with Comments

78 The Kentucky Transportation Cabinet is responsible for controlling both public and private usage of right-of-way of the State road system. Any firm, individual, or government agency desiring access to a State road or desiring to perform any type of work (including signage, boring, etc.) on or adjacent to State right-of-way must obtain a permit from the Department

Any proposed access or encroachment of a State maintained road right-of- way should be coordinated at the earliest stage with:

Tom Hines, P.E. Permits Engineer
Kentucky Department of Highways, District 1
5501 Kentucky Dam Road, Paducah, Kentucky 42003
Telephone: (270) 898-2431 or 1 (800) 338-4283, Fax: (270) 898-7457

Endorsed by: Jessica Herring, EIT, Planning Section Supervisor
Kentucky Department of Highways, District 1
5501 Kentucky Dam Road, Paducah, Kentucky 42003
Telephone: (270) 898-2431 or 1 (800) 338-4283, Fax: (270) 898-7457

KY Heritage Council
Yvonne Sherrick

79 To receive a review from the KY Heritage Council/State Historical Preservation Office (SHPO) you must follow the instructions located on their website at http://www.heritage.ky.gov/siteprotect/ . There you will find the required documents for the Section 106 Review and Compliance for 36 CFR Part 800. This Section 106 submission process to SHPO will assist applicants and agencies in providing the appropriate level of information to receive comments from SHPO.

If you have any questions please contact Yvonne Sherrick, Administrative Specialist III, (502) 564-7005, Ext. 113, yvonne.sherrick@ky.gov

80 **PURCHASE AREA DEVELOPMENT DISTRICT**
BRAD DAVIS
No comment

United States Department of the Interior

OFFICE OF THE SECRETARY

Office of Environmental Policy and Compliance
Richard B. Russell Federal Building
75 Ted Turner Drive, S.W., Suite 1144
Atlanta, Georgia 30303

ER 17/0297
9043.1

July 24, 2017

Ashley Pilakowski
NEPA Compliance Specialist
400 West Summit Hill Drive, WT 11D
Knoxville, TN 37902-1499

Re: Comments on the Draft Environmental Impact Statement by the Tennessee Valley Authority for the Shawnee Fossil Plant Coal Combustion Residual Management

Dear Ms. Pilakowski:

70 The United States Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement by the Tennessee Valley Authority for the Shawnee Fossil Plant Coal Combustion Residual Management. We offer no comments at this time.

Thank you for the opportunity to provide comments. If you have questions, please contact Bryan Faehner at bryan_faehner@nps.gov. I can be reached at (404) 331-4524 or via email at joyce_stanley@ios.doi.gov.

Sincerely,

Joyce Stanley, MPA
Regional Environmental Officer

cc: Christine Willis – FWS
Michael Norris - USGS
Anita Barnett – NPS
Robin Ferguson – OSRME
OEPC – WASH

SIERRA CLUB

July 31, 2017

Ms. Ashley Pilakowski
NEPA Compliance
Tennessee Valley Authority
400 W. Summit Hill Drive, WT 11DK
Knoxville, Tennessee 37902
aapilakowski@tva.gov

Via electronic mail as well as upload on www.tva.gov/nepa

<u>Re:</u> **<u>Comments on Tennessee Valley Authority's June 2017 Draft Environmental Impact Statement for the Shawnee Fossil Plant's Coal Combustion Residual Management</u>**

Dear Ms. Pilakowski:

The **Sierra Club**, the **Kentucky Environmental Foundation** ("KEF"), the **Kentucky Conservation Committee** ("KCC"), the **Southern Alliance for Clean Energy** ("SACE"), the **Environmental Integrity Project** ("EIP"), and **Mark Quarles**, a consultant with Global Environmental, LLC, have reviewed the Tennessee Valley Authority's ("TVA") June 2017 Draft Environmental Impact Statement for the Shawnee Fossil Plant's Coal Combustion Residual Management (the "DEIS"),[1] and hereby submit their comments, consisting of this letter together with the attached Technical Comments prepared by Mr. Quarles.

The DEIS suffers from numerous material flaws, procedural as well as substantive, which both
render the DEIS legally defective and pose potential hazards to human health and the
environment. Our conclusions are based on an intensive review of numerous technical
documents in conjunction with applicable laws and regulations. To that end, we scrutinized not
only the DEIS itself but also TVA documents produced during past discoveries, documents
1 produced by TVA on its CCR website, and many other publically available technical reports,
among other materials.

As a general matter, we believe that TVA has not performed proper and adequate analyses necessary to defensibly select a preferred alternative for closure of current disposal units or for selecting a disposal site for long-term disposal of wastes. We believe that the DEIS and its

[1] *See, e.g.*, 82 Fed. Reg. 27,704 (June 16, 2017) (notice of availability of Shawnee Fossil Plants Coal Combustion Residual Management—noting public comment period as ending on July 31, 2017).

1 proposed courses of action would, if finalized as they currently stand, violate the National Environmental Policy Act ("NEPA")[2] and the CCR Rule,[3] at least—potentially other laws as well (*e.g.*, the Resource Conservation and Recovery Act ("RCRA")[4] and/or the Clean Water Act,[5] *inter alia*).

Our general conclusions concerning the DEIS, explained and supported in the attached technical comments, are as follows:

5 1. TVA's plan to eliminate all wet storage of coal combustion residuals ("CCR") at Shawnee through closure of the Special Waste Landfill and Ash Impoundment 2 would not eliminate the ash's contact with groundwater, nor would it eliminate continued leaching of hazardous contaminants from those disposal areas.

11 2. TVA's own monitoring of groundwater and surface water demonstrates widespread contamination, and that contamination discharges into the receiving streams; yetTVA's plan for closure and construction of new disposal units would not prevent that discharge of contamination from occurring in the future, nor would existing permit conditions be able to quantify or mitigate the potential long-term adverse effects.

25 3. TVA's plan for Closure-in-Place of the Special Waste Landfill and Ash Impoundment 2 would not satisfy the closure performance standards for surface impoundments legally required by the CCR Rule.

34 4. Nowhere has TVA shown that its plan to laterally expand the Special Waste Landfill over Ash Impoundment 2 would satisfy the location restriction requirements legally required by the CCR Rule.

47 5. TVA's preliminary alternatives analysis to evaluate future "dry" landfill disposal sites to accommodate Shawnee's waste generation plan was unreasonably brief; moreover, it resulted in the selection of land that was already purchased by TVA, that does not meet TVA's minimum designated acreage requirement, and that likely would not meet the CCR rule site location standards.

49 6. TVA's elimination of Closure-by-Removal as a facility-wide alternative in the DEIS was not based upon reasonable facts and considerations that TVA should have considered in its analysis.

---

[2] 42 U.S.C. § 4321 *et seq.*; *see* 40 C.F.R. pts. 1500-1508.

[3] *Disposal of Coal Combustion Residuals from Electric Utilities*, 80 Fed. Reg. 21,301 (Apr. 17, 2015) (final rule); *see* 40 C.F.R. pts. 257 & 261.

[4] 42 U.S.C. § 6901 *et seq.*

[5] 33 U.S.C. § 1251 *et seq.*

SIERRA CLUB

7. The DEIS improperly omits relevant information regarding all past, current, and
55 proposed future waste disposal areas. As such, the DEIS does not properly evaluate the
waste management process in compliance with the CCR Rule and NEPA.

8. TVA failed to include, as it should have, analysis of beneficial reuse, in evaluating waste
alternatives. Currently disposed and future wastes are capable of being beneficially
40 reused in commercial products. Factoring in that analysis could materially change the
relative economics of, and therefore TVA's informed choice between, the different
alternatives.

9. The DEIS improperly relies upon the Programmatic EIS and its EPRI Framework Model
to support Closure-in-Place of the Special Waste Landfill and Ash Impoundment 2; the
69 EPRI Framework Model, which the PEIS in turn relied upon, is flawed and should not
have been invoked for the Shawnee site.

Please see the attached technical comments, which expand upon the aforementioned problems with the DEIS. As noted in the technical comments, the References cited therein have been collected and made available for download at the following publically-accessible Box site (it would be impracticable to attach them, given the file sizes): https://app.box.com/s/rz005s7adftddh5ghugvzlmznlemdsti. Please let me know if you have any questions or problems accessing the documents on that site.

We sincerely appreciate this opportunity to comment and thank you in advance for your consideration. We look forward to hearing from TVA and would be very pleased to discuss alternative paths forward, including how TVA might remedy the flaws in the DEIS. Please do not hesitate to contact me with any questions, concerns, or requests.

Sincerely,

Matthew E Miller

_/s/ *Matthew E. Miller*_______________

Matthew E. Miller, Esq.
Sierra Club Staff Attorney
50 F Street, NW, 8th Floor
Washington, DC 20001
Tele: 202-650-6069
Fax: 202-547-6009
Email: matthew.miller@sierraclub.org

Enclosure: Technical Comments

Technical Comments Regarding the Draft Environmental Impact Statement (v. June 2017)

Tennessee Valley Authority's Shawnee Fossil Plant Coal Combustion Residual Management

Prepared for:

Sierra Club
50 F Street NW, 8th Floor
Washington, DC 20001

Prepared by:

Global Environmental, LLC
Mark Quarles, P.G.
PO Box 58302
Nashville, Tennessee 37205

July 2017

Global Environmental, LLC
Environmental Consulting

TABLE OF CONTENTS

1. **Introduction**

1-1. Purpose

The Tennessee Valley Authority ("TVA") stated that the purposes of its June 2017 Draft Environmental Impact Statement (the "DEIS") for Shawnee Fossil Plant's ("Shawnee") Coal Combustion Residuals ("CCR") Management were:

- "to support TVA's goal to eliminate all wet storage at [Shawnee]";
- "provide additional dry CCR material storage"; and
- "assist TVA in meeting the new CCR regulations."

DEIS at 5.[1]

1-2. Overview of Comments; Prematurity of DEIS

1 The DEIS fails to achieve its stated purposes and suffers from additional defects, procedural as well as substantive, detailed below, which violate various standards and requirements in the National Environmental Policy Act ("NEPA")[2] and the CCR Rule,[3] at least—and potentially other laws/regulations as well (*e.g.*, the Resource Conservation and Recovery Act ("RCRA")[4] and/or the Clean Water Act,[5] *inter alia*). Not only are TVA's analytical shortcomings legally problematic; they also pose potential hazards to human health and the environment, if finalized as currently proposed. TVA should therefore refrain from implementing the DEIS, and should reconsider alternatives after it has properly addressed the flaws discussed herein.

58 It should be noted that TVA completed the DEIS even though the current Special Waste Landfill (alternatively referred to as the "SWL" or the "Consolidated Waste Dry Stack") has enough capacity to last for another 10 years (until 2027), and the proposed new landfill would not be needed until that time. DEIS at 1. As such, in addition to its other flaws noted below, the DEIS is premature at this point. This lack of urgency further counsels towards TVA not moving ahead with finalizing the problematic proposals in the DEIS.

---

[1] TVA DEIS, Shawnee Fossil Plant Coal Combustion Residual Management, *available at* https://www.tva.gov/file_source/TVA/Site%20Content/Environment/Environmental%20Stewardship/Environmental%20Reviews/Shawnee%20Coal%20Combustion%20Residual/SHF_CCR_EIS_DRAFT_060717.pdf (last accessed July 26, 2017).

[2] 42 U.S.C. § 4321 *et seq.*; *see* 40 C.F.R. pts. 1500-1508.

[3] *Disposal of Coal Combustion Residuals from Electric Utilities*, 80 Fed. Reg. 21,301 (Apr. 17, 2015) (final rule); *see* 40 C.F.R. pts. 257 & 261.

[4] 42 U.S.C. § 6901 *et seq.*

[5] 33 U.S.C. § 1251 *et seq.*

2. **<u>Failure to Eliminate Ash Contact with Groundwater, and Leaching of Contaminants</u>**

5 First among the several significant defects in the DEIS, TVA's plan to "eliminate all wet storage" of CCRs through closure of Ash Impoundment 2 and the SWL would not eliminate the ash's contact with groundwater, nor would it eliminate continued leaching of hazardous contaminants from those disposal areas. This renders TVA's proposal unlawful under both applicable substantive legal requirements pertaining to CCR, and NEPA's mandate for reasoned decision-making based on a record of fulsome, accurate analysis.

55 TVA identified only two current or former disposal areas as subject to the U.S. Environmental Protection Agency's ("EPA") CCR Rule and as a focus of consideration in the DEIS: namely (1) Ash Impoundment 2, and the (2) Special Waste Landfill (alternatively referred to as the "SWL" or the "Consolidated Waste Dry Stack"). Crucially, however, *there are in fact other former disposal areas that were not explicitly discussed in the DEIS and that TVA's proposed plan fails to consider*, as the CCR Rule and NEPA, at least, require.

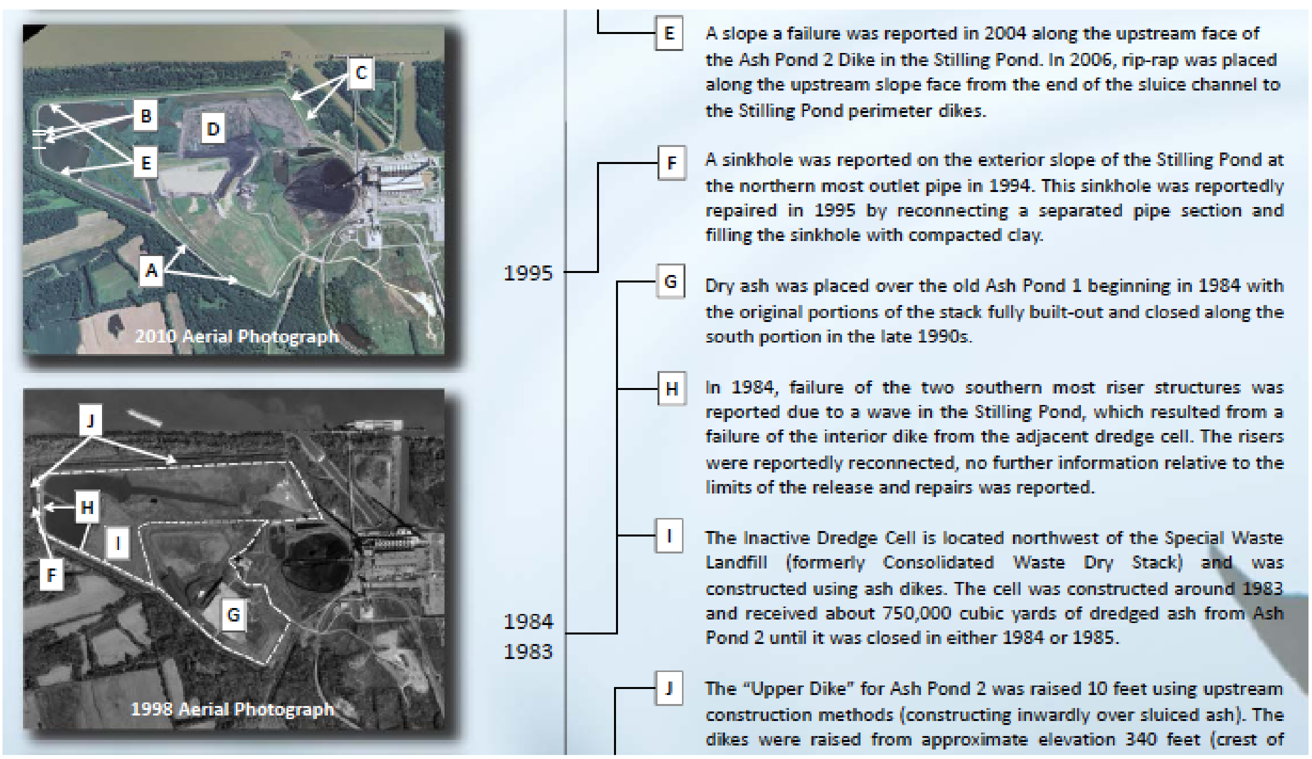
Ash Impoundment 2, the SWL, and these other disposal areas are illustrated below in Graphic 1:

a. Graphic 1: Photographic depiction of the Shawnee site

6 TVA explains that it "deemed it appropriate to tier closure of the SWL from" TVA's 2016 Ash Impoundment Closure Final Environmental Impact Statement Part I Programmatic Review, or "PEIS," due to the SWL's "location with respect to Ash Impoundment 2 and the former footprint of Ash Impoundment 1." DEIS at 26. TVA is correct in its determination of similarities to Ash Impoundment 2 because the SWL is in fact an "inactive surface impoundment" according to the CCR Rule, as discussed below.

The SWL was built over the original surface impoundment, namely Ash Impoundment 1, at the Shawnee site. TVA sluiced ash to that impoundment from 1956 to 1970. *See* Stantec 2016a, at Appendix B.[6] Although the disposal area has a solid waste permit with the Kentucky Division of Waste Management ("KDWM"), the bottom portion of the landfill and the dikes that formed the base of the landfill are the original dikes of the surface impoundment. Ash Impoundment 1 and a portion its construction history are illustrated in Graphic 2 (*see* Stantec 2016a, at Appendix B):

b. Graphic 2: Ash Impoundment 1 and selected construction history

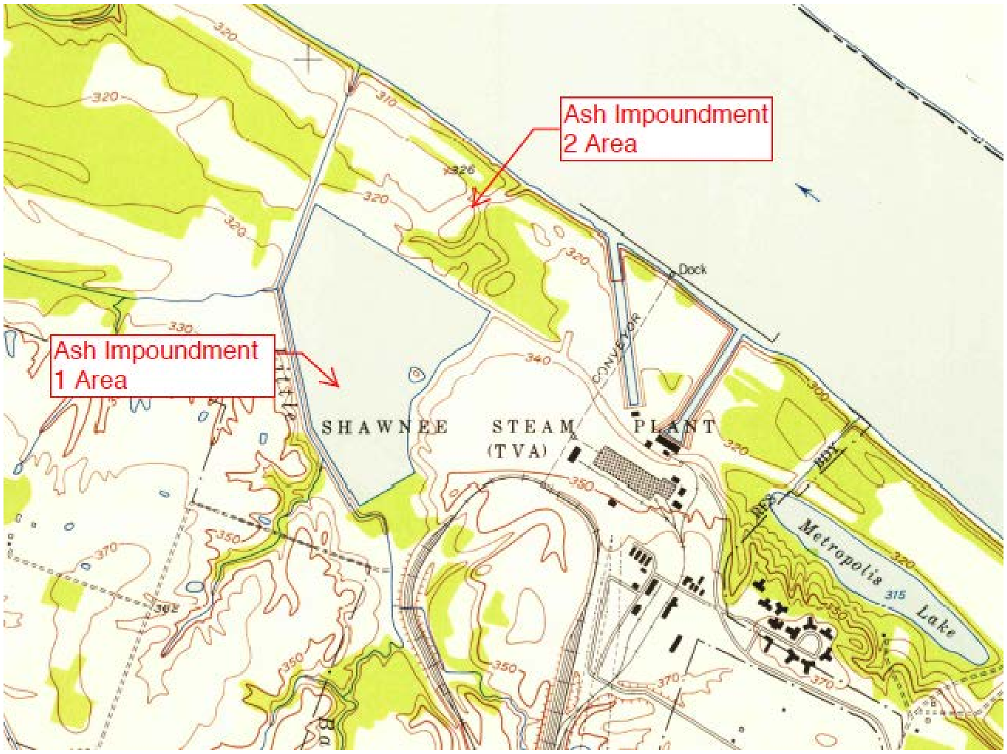


A review of the oldest available topographic map prepared by the U.S. Geological Survey ("USGS") demonstrates that TVA relocated the original channel of Little Bayou Creek to construct Ash Impoundment 1 and place fill into the old stream channel. *See* USGS 1954. The map further illustrates that the original ground topography beneath Ash Impoundment 2 ranged from 310 to 320 feet above mean sea level ("MSL"), as shown below in Graphic 3 (*see* USGS 1954):

---

[6] The fuller citations for technical sources noted herein are provided in the References pages, *infra* Section 11. As noted below, each source has been collected and made available for download at the following publically-accessible Box site (it would be impracticable to attach them all hereto, given the file sizes): https://app.box.com/s/rz005s7adftddh5ghugvzlmznlemdsti.

c. Graphic 3: Locations and topography of SWL (Ash Impoundment 1) and Ash Impoundment 2



TVA began sluicing both fly ash and bottom ash to Ash Impoundment 2 in 1971. *See* Stantec 2016b at Appendix B. And as Stantec, an environmental consulting firm, has confirmed on behalf of TVA, that Ash Impoundment 2 was constructed *without a liner* that complies with the CCR Rule. *See* Stantec 2016c, at 1. Nevertheless, TVA continues to sluice ash into the impoundment, and has also constructed an expansion of the SWL over that (unlined) impoundment.

7 To the same end, given that TVA constructed Ash Impoundment 1 before constructing Impoundment 2, one can assume that Ash Impoundment 1 was also constructed without a liner.

The 2007 horizontal expansion of SWL—which, again, was constructed over what was originally Ash Impoundment 1—over Ash Impoundment 2 continues to current day. The horizontal expansion over the surface impoundment likely does not meet the current CCR Rule technical requirements for a new lateral expansion of a surface impound or landfill.[7]

Groundwater and leachate continue to seep from Ash Impoundment 2 onto the ground surface
adjacent to the dikes. TVA stated that seepage along the southeast dike of that impoundment
occurred for "nearly 20 years" and that the "repair" consisted of covering the wet discharges with a
8 "graded filter." *See* Stantec 2016a, at Appendix B. However, that "filter" does not eliminate or
prevent continued seepage of leachate onto the ground surface. The seepage area is not an area that
contains standing water in the impoundment. Therefore, the seepage is originating from saturated
CCRs *below the ground surface*.

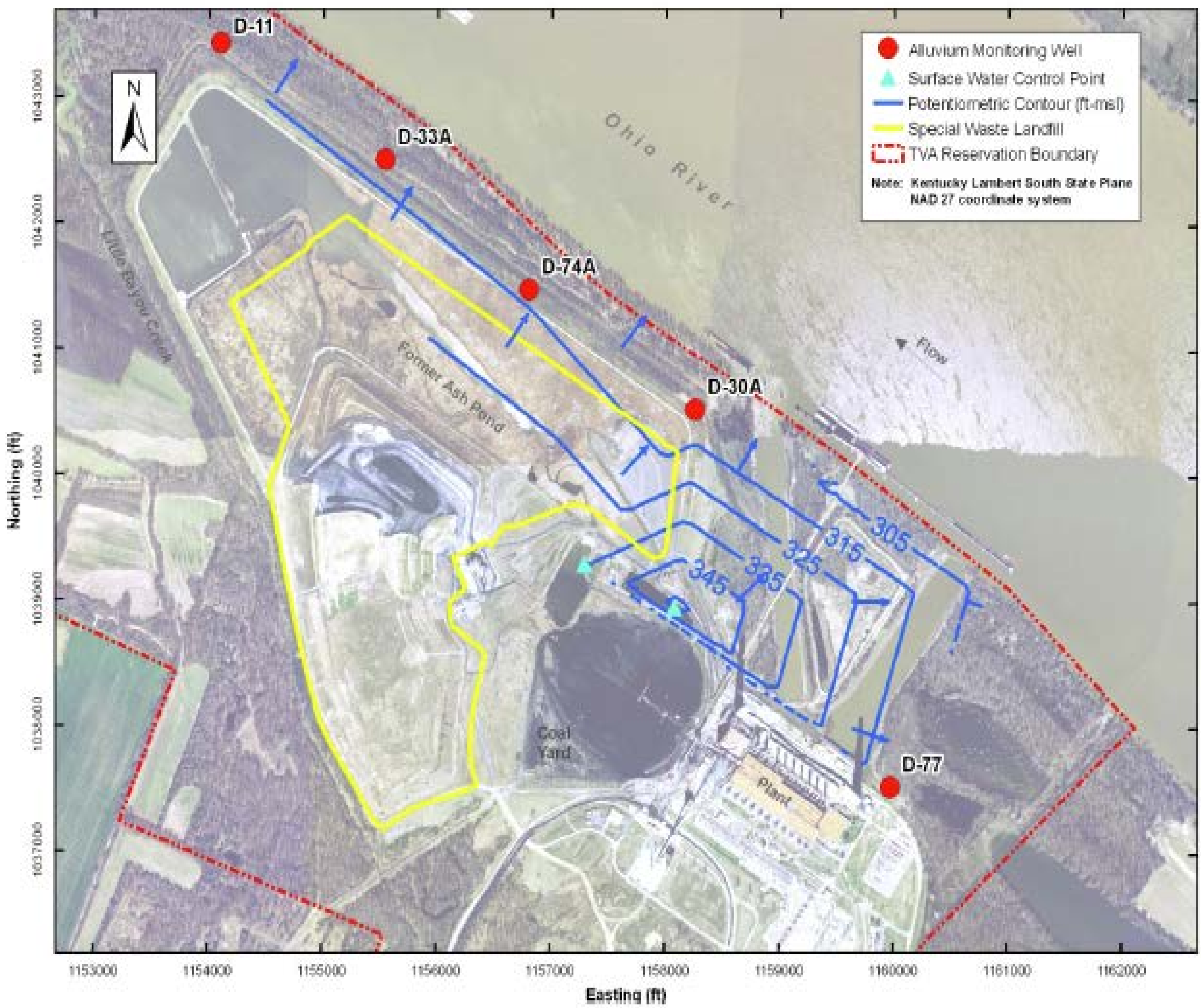
[7] *See also infra* Section 5.

TVA has known since at least 1982 that ash in the impoundments is likely in contact with groundwater. *See* TVA 1982, at 61. TVA concluded that “water-table elevations are probably within the ash disposal ponds much of the year” and that “the elevation of the water table is related directly to the amount of groundwater in storage which varies with the stage of the river.” *Id.*

TVA’s investigation in 1989 demonstrated that groundwater beneath Ash Impoundment 1 (now
9 called the “Special Waste Landfill” by TVA) was “mounded” and that “groundwater is in contact with the fly ash in the inactive pond”—even though waste disposal ended 19 years earlier in 1970. *See* TVA 1989, at 14 and 26.

Groundwater monitoring in 2010 illustrates the *continued* “mounding” effect (up to 345 ft. MSL) on the shallow alluvial aquifer, despite the fact that the disposal operations over Ash Impoundment 2 and in the SWL are “dry,” as illustrated in Graphic 4 (*see* TVA 2010):

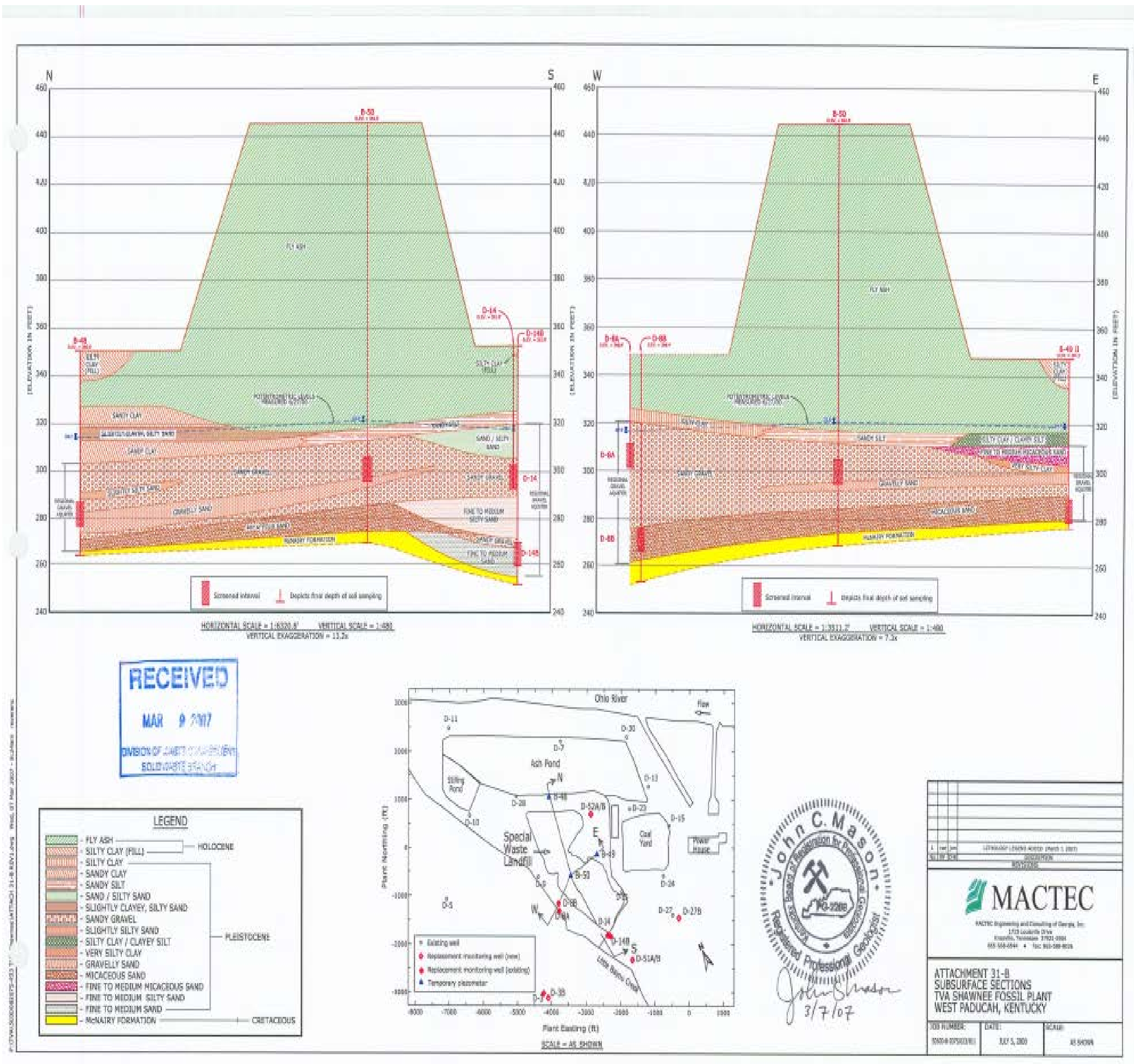
d. Graphic 4: Mounding effect on alluvial aquifer



TVA's 1989 investigation for Ash Impoundment 2 concluded that "data in the wells near the ash pond suggest that saturation (down to the regional aquifer) is likely." TVA 1989, at 27.

To obtain approximate original ground topographic elevations beneath Ash Impoundment 1, I reviewed boring logs and cross-sections reported by Mactec. *See* Mactec 2007, at 138 and 147 (by PDF pagination). That data, based on use of a boring (B-50) drilled into the center of the SWL and
9 others through the perimeter dikes, demonstrated that TVA sluiced wastes onto the original ground elevation (estimated to be 316 ft. MSL in the illustration below), and that groundwater (based upon 2000 measurements) saturates the wastes, as illustrated below in Graphic 5. As such, groundwater remained in contact with the wastes 30 years after TVA terminated wet sluice operations in that impoundment.

e. Graphic 5: Cross-sections showing groundwater saturation of sluiced wastes



More recent 2016 piezometer results from the SWL and Ash Impoundment 2 areas drilled through the perimeter dikes demonstrated that:

- Ash within the SWL likely remains saturated because the water elevations ranged from 319 feet to 335.3 feet MSL—compared, as an example, to the approximate 316 feet MSL original ground surface discussed above.
- Ash within Ash Impoundment 2 also likely remains saturated—even in areas with no standing water at the ground surface—because groundwater elevations ranged from 315.5 feet to 344.2 feet MSL - compared to the estimated original ground surface elevations ranging from 310 feet to 320 feet MSL.

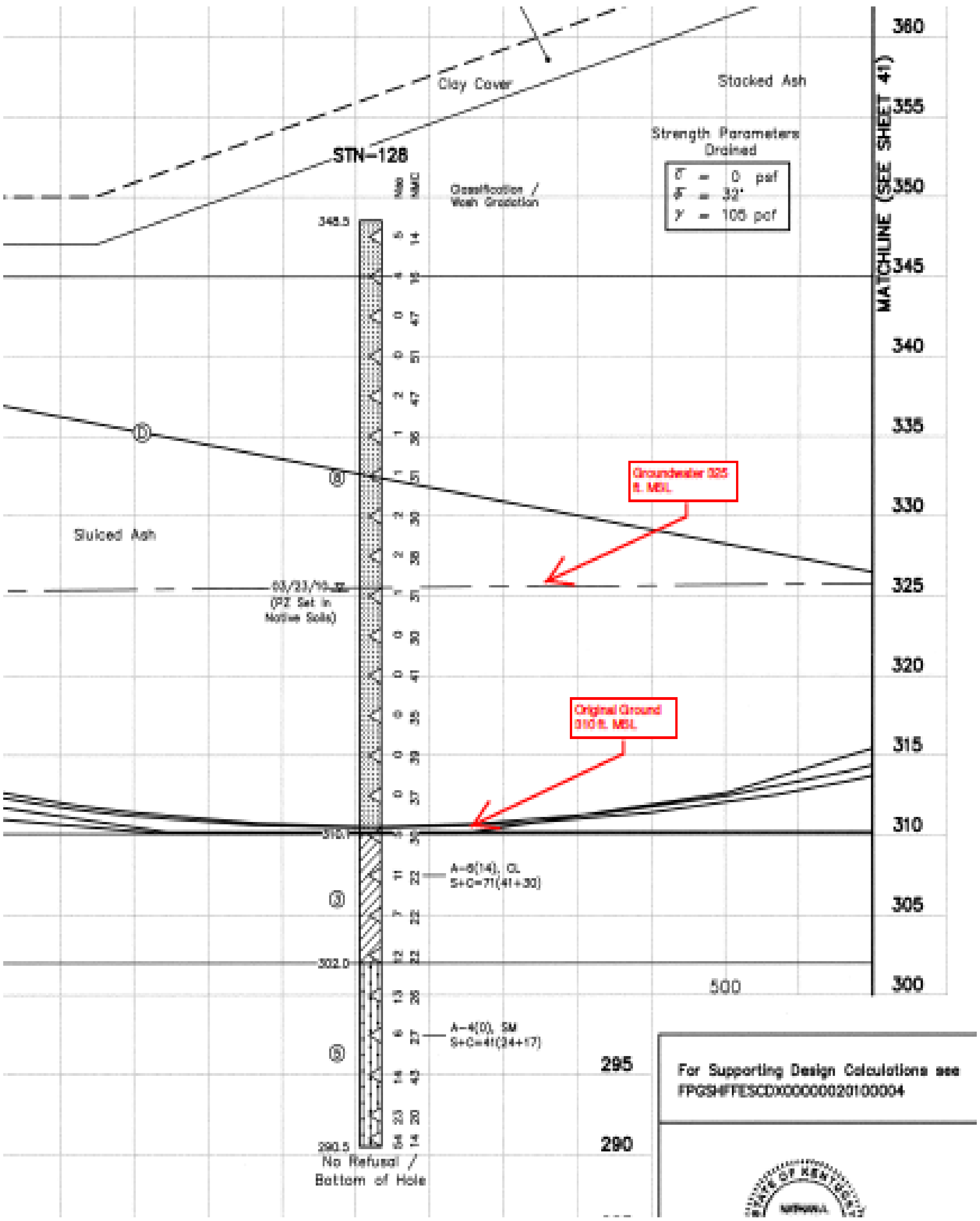
See Triad 2016, Figure 10W313-01 and Table SHF Instrumentation Data, at 18 and 19 (PDF
9 pagination).

The groundwater elevations reported by Triad in 2016 are consistent with Stantec's findings 6 years earlier, in 2010, when the latter firm conducted a geotechnical drilling study of perimeter dikes and into the ash (only one boring into the ash). *See* Stantec 2016a, at 40 (PDF pagination) (incorporating 2010 findings). Notably, TVA relied upon Stantec's work in documenting the construction of Ash Impoundment 2, linking to the study to provide the "History of Construction" for Ash Pond 2 (*i.e.*, Ash Impoundment 2) on its Shawnee CCR website.[8] Stantec demonstrated that:

- Groundwater is in substantial contact (at least 15 feet) with the CCRs in Ash Impoundment 2; and
- Ash was placed onto the original ground in that area to at least 310 feet MSL, as illustrated below in Graphic 6. *See* Stantec 2016a, at 40 (PDF pagination).

[8] The 2016 Stantec study *History of Construction* is linked to from TVA's Shawnee Coal Combustion Residuals website, from the link Surface Impoundment - Ash Pond 2 > Design Criteria > History of Construction. *See* https://www.tva.gov/Environment/Environmental-Stewardship/Coal-Combustion-Residuals/Shawnee (main page, linking to study); *see also* https://ccr.tva.gov/Plants/SHF/Surface%20 Impoundment%20-%20Ash%20Pond%202%20(Main%20Ash%20Pond%20and%20Stilling%20Pond) /Design%20Criteria/History%20of%20Construction/257-73(c)_History%20of%20Construction_SHF _Ash%20Pond%202%20 (Main%20Ash%20Pond%20and%20Stilling%20Pond).pdf (the study link).

f. Graphic 6: Groundwater contact with CCRs in Ash Impoundment 2



9 Given my analysis of the information above—information prepared at the behest of TVA, which TVA used to support Closure-in-Place—the data indicate the **strong likelihood that CCRs in both the SWL and Ash Impoundment 2 remain saturated and in contact with the uppermost aquifer**.

10 The foregoing analysis further shows that the bottom portion of the SWL (*i.e.*, Ash Impoundment 1) is an "inactive CCR surface impoundment" within the meaning of the CCR Rule because the impoundment *still contains both solid CCRs and liquids*. 40 C.F.R § 257.53 ("Inactive CCR surface

impoundment means a CCR surface impoundment that no longer receives CCR on or after October 19, 2015 and still contains both CCR and liquids on or after October 19, 2015.”). As such, the bottom portion of the SWL (Ash Impoundment 1) is subject to the significant applicable
10 requirements as a “surface impoundment” under the CCR Rule, *see, e.g. id.* §§ 257.50(b)-(c); *id.* § 257.100(a) (“Inactive CCR surface impoundments are subject to all of the requirements of this subpart applicable to existing CCR surface impoundments.”); *id.* § 257.100(e). **The DEIS fails to take that status and its important attendant obligations into account, however.**

3. **Failure to Address Discharge of Contamination into Groundwater and Surface Waters**

TVA's own monitoring of groundwater and surface water demonstrates widespread contamination,
and that contamination discharges into the receiving streams. However, TVA's plan for closure and
11 construction of new disposal units would not prevent that discharge of contamination from occurring
in the future, nor would existing permit conditions be able to quantify or mitigate the potential long-
term adverse effects.

Groundwater sampling beginning in 1985 of the first three monitoring wells demonstrated that the disposal operations had already contaminated groundwater in 2 wells (wells 8 and 9) located along Little Bayou Creek. *See* TVA 1987, at 7. That contamination included arsenic, iron, lead, manganese, pH, selenium, sulfate, and total dissolved solids. Concentrations for arsenic, selenium, and lead had exceeded the Maximum Contaminant Level ("MCL"). For example, the mean concentrations of arsenic in those three wells from 1985 to 1987, met or substantially exceeded EPA's Maximum Contaminant Level of 10 parts per billion ("ppb"): Wells 7, 8 and 9 were at 75, 100, and 10 ppb. *See id.*; *see also National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring*, 66 Fed. Reg. 6,975, 6,981 (Jan. 22, 2001).

According to a TVA, as early as 1987, groundwater mounding beneath the ash impoundment area causes groundwater to flow towards and into Little Bayou Creek *and* the Ohio River. *See* TVA 1987, at 3. TVA determined that the soil within the wells with contaminated groundwater was very porous, concluding that "no soil layer that would restrict or slow migration of leachate into the groundwater" exists because the ground surface beneath the wastes was underlain in some places with sand, pebbles, and gravel. *Id.* at 8.

TVA continued to conclude two years later in 1989 that the contaminated groundwater discharges into Little Bayou Creek – concluding "data collected so far indicate that the ash pond disposal areas are affecting the creek." *See* TVA 1989, at 238, 261 (PDF pagination).

Little Bayou Creek is afforded protection as a stream in the Commonwealth of Kentucky. In fact, it is currently listed as an impaired waterway according to the Kentucky Division of Water and has an established Total Maximum Daily Load ("TMDL") for polychlorinated biphenyls ("PCBs") due to upstream activities at the Paducah Gaseous Diffusion Plant. *See* KDW 2001.

Groundwater monitoring as recent as November 2016 (reported in January 2017) for the SWL and
Ash Impoundment 2 indicated continued groundwater contamination due to leachate migration from
unlined disposal units. *See* TVA 2017, at 11 and 12 (PDF pagination). TVA concluded that
"statistical findings indicate the likelihood of coal-combustion by-product effects on groundwater
beneath and downgradient of the Special Waste Landfill." *Id.* TVA concluded that three water-
12 bearing units from shallow to deep were affected:

1. the alluvial soil aquifer;
2. the Upper Continental Deposits aquifer; and
3. the Regional Gravel Aquifer.

Id.

12 Nevertheless, TVA apparently did not evaluate the results of any wells associated with Ash Impoundment 2. That failure to evaluate was unreasonable.

The reported statistical exceedences for the SWL area were as follows:

1. Alluvial Aquifer – boron, molybdenum, and pH.
2. Upper Continental Deposits Aquifer – boron, calcium, total organic carbon, iron, magnesium, manganese, potassium, specific conductance, strontium, sulfate, and total dissolved solids.
3. Regional Gravel Aquifer – alkalinity, boron, calcium, cobalt, chemical oxygen demand, fluoride, magnesium, manganese, nickel, pH, potassium, specific conductance, strontium, sulfate, and total dissolved solids.

See TVA 2017, at 11 and 12 (PDF pagination).

My review of the tabulated groundwater results from the November 2016 sampling yielded the following general observations:

- Concentrations of some constituents in wells along the Ohio River increased with depth. For example, boron concentrations in wells for Ash Impoundment 2 increased from 2.33 ppm in well D-74A (alluvium well) to 3.99 ppm in a deeper, adjacent cluster well D-74B (Regional Gravel Aquifer).
- Concentrations of some constituents in some wells along Little Bayou Creek decreased with depth. For example, boron from cluster wells D-75A (Upper Continental Deposit) and D-75B (Regional Gravel Aquifer) decreased from 8.16 ppm to 5.46 ppm. Sulfate concentrations also decreased from 780 ppm to 386 ppm.
- Sulfate concentrations routinely exceeded the EPA Secondary Maximum Contaminant Level ("SMCL") for sulfate (250 ppm), manganese (0.05 ppm), and iron (0.3 ppm), as examples. As examples, sulfate concentrations in these wells: D75A (780 ppm) and D75B (386 ppm).
- Boron routinely exceeded state-based health advisory concentrations (ranging from 0.6 to 1 ppm). *See* EPA 2008 at 37. As examples, boron concentrations in these wells: D11B (1.65 ppm), D33A (2.21 ppm), D74A (2.33 ppm), D74B (3.99 ppm), D65A (8.16 ppm), and D75B (5.46 ppm).[9]

Consistent with TVA's conclusion 30 years earlier, in 1987, TVA determined in 2017 that surface water collected from Little Bayou Creek downstream from the SWL, the Dredge Cell, and the Stilling Pond continues to be affected by leakage from the adjacent disposal units and groundwater discharge into the creek. TVA concluded that "upstream-downstream data comparisons for the LBC (Little Bayou Creek) result in higher concentrations of boron, calcium, and sulfate at SW-D (downstream) than at upstream station SW-C." TVA 2017 at 40 (PDF pagination). TVA also reported higher downstream results in the Ohio River for sulfate as compared to an upstream location—thereby

[9] Notably, several of these constituents at issue, including boron, pH, sulfate, and total dissolved solids ("TDS"), are defined by EPA as indicators of CCR contamination. *See Hazardous and Solid Waste Management System*, *Disposal of Coal Combustion Residuals from Electric Utilities*, Final Rule, 80 Fed. Reg. 21,302, 21,397 (Apr. 17, 2015) ("The parameters EPA proposed to be used as indicators of groundwater contamination were the following... ."); *id.* at 21,403 (finalizing the proposed list of indicators after removing conductivity and sulfide from the list); *see also* 40 C.F.R. pt. 257 App'x III (final list of indicators used for detection monitoring).

indicating groundwater discharges also affect the Ohio River along Ash Impoundment 2, notwithstanding the river's significant flow. *See id.*

13 TVA stated in the DEIS that its proposed new landfill (Option 1, reference to as the "Shawnee East Site") will be designed with a leachate collection system and that leachate will be "sent to the onsite processing impoundment where it would be conveyed to the Ohio River through a Kentucky Pollutant Discharge Elimination System ("KPDES") permitted outfall." DEIS at 21. However, TVA:

- failed to explain which impoundment will receive that leachate;
- failed to explain whether that unit is or will be lined to protect groundwater quality; and
- failed to explain how that impoundment will "process" that leachate to be protective of receiving streams and groundwater.

14 The DEIS states that all future discharges to local surface waters will be protective because the discharges will be in accordance with the existing KPDES permit and in compliance with Water Quality Standards. *See* DEIS at 81-83. Yet that claim is misleading, because the Shawnee permit *does not include any numeric limitations for any metal, nor does it include all constituents* (e.g., boron, sulfate) that are known to be in the groundwater due to leakage from the unlined surface impoundments. Absent such numeric limits along with an understanding of the assimilative capacity, the fish and aquatic life, and the benthic invertebrate conditions in the receiving streams, **TVA cannot confidently claim that current and future discharges will be protective of human health and the environment.**[10]

15 TVA stated in the DEIS that closure of the SWL and Ash Impoundment 2 and the construction of the proposed Shawnee East Site landfill will change the water quality that is discharged into streams—yet TVA has offered no definitive plans on how it plans to treat the wastewater. TVA referred to a pair of studies that TVA performed to "inform the process," *see id.* at 83, but it failed to include the results of those studies in order to propose a plan for leachate and stormwater treatment prior to discharging into receiving streams. Therefore, TVA cannot claim that its future discharges will be protective of human health and the fish / aquatic life of the receiving streams.

16 Further, TVA concluded that "no direct impacts to aquatic ecosystems of the Ohio River or Little Bayou Creek would occur in conjunction with construction of the proposed Shawnee East Site landfill or closure of the SWL and Ash Impoundment 2. *Id.* at 103. That claim is baseless, because TVA has not collected any aquatic information from Little Bayou Creek, the Ohio River in the area of the Shawnee Plant, the unnamed tributary into which runoff from Shawnee East Site landfill will be discharged, or ponds and wetlands located on Shawnee East Site. *See id.* at 100-101. TVA should have performed an aquatic survey of all of those water-bodies and presented the results in the DEIS.

17 TVA stated in the DEIS that water generated from a proposed new bottom ash dewatering facility could either be discharged into a receiving stream or be "recirculated back into the system." *Id.* at

[10] Worth of note here, non-exhaustively, the Clean Water Act authorizes citizen suits based on violations of effluent standards or limitations, *see* 33 U.S.C. § 1365(a)(1), and RCRA authorizes citizen suits based on violations of solid waste standards, or on endangerment to health or the environment, 42 U.S.C. § 6972(a)(1).

17 175. TVA should have included that analysis in the DEIS and that analysis should have included recirculation of all wastewaters to result in *zero discharges* to receiving streams.

18 In summary, TVA has not yet quantified in the DEIS how either the proposed Closure-in-Place alternative for the SWL or Ash Impoundment 2 or the construction of the proposed Shawnee East Site landfill will affect baseline surface water and groundwater conditions, or how those closures will improve groundwater and surface water quality. Moreover, TVA acknowledged that Closure-in-Place is less protective of groundwater when compared to Closure-by-Removal, and that it is uncertain that Closure-in-Place with a cap over the wastes will even improve groundwater quality when ash is in contact with groundwater. *See* TVA 2016, Appendix A at 29. Given the proximity of the SWL and Impoundment 2 to rivers and streams and the ineffectiveness of a cap upon closure to prevent saturated wastes from continuing to contaminate groundwater that flows into streams, **one can expect contaminated groundwater to flow into receiving surface waters for the foreseeable future**.

4. **Failure to Satisfy Applicable Closure Performance Standards**

25 TVA's plan for Closure-in-Place of the Special Waste Landfill and Ash Impoundment 2 would not satisfy the closure performance standards for surface impoundments required by the CCR Rule.

TVA's Preferred Alternative for closure of the SWL and Ash Impoundment 2 is a combination of the following:

- Constructing a horizontal expansion of the SWL (in addition to the one that already occurred in 2007) over the unlined portion of Ash Impoundment 2.
- Removing "visible ash" from an unspecified "northwest corner of Ash Impoundment 2."
  - 26 Notably, TVA failed to define what "visible" means, how deep the ash will be excavated, or how many cubic yards will be excavated.
- Placing the excavated ash from that northwest corner into the SWL horizontal expansion over the unlined Ash Impoundment 2.
- Capping that horizontal expansion area of the SWL in the future.
- Constructing a new perimeter dike in an undisclosed area "along the northern boundary of the SWL."
- Removing the remaining Ash Impoundment 2 dikes and "support structures" along the northern boundary.
- Constructing a new Equalization Basin to receive "wet ash."

DEIS at 38.

TVA has still not provided essential groundwater information that is needed to justify its selection of the Closure-in-Place alternative. Indeed, TVA selected the Closure-in-Place alternative without providing the following basic, important information necessary to support such a method:

1. Depth to groundwater within the CCRs;
2. Depth of CCRs relative to the three hydraulically connected uppermost aquifers already identified by TVA;
3. The amount of groundwater mounding that is currently present and how much the proposed cap will actually reduce that mounding effect;
4. 27 The quantity of leachate that is currently seeping downward and into groundwater and how much the proposed cap will reduce or eliminate that leakage to groundwater;
5. How much groundwater flows laterally from up-gradient areas and into the CCRs in order to prevent all contact of groundwater with wastes;
6. How leachate and groundwater flows into and interacts with the receiving stream;
7. Soil permeability and hydraulic conductivity conditions beneath the wastes to estimate how fast leachate seeps vertically and horizontally; and
8. The horizontal groundwater flow velocities in the Alluvial Aquifer, the Upper Continental Deposits Aquifer, and the Regional Gravel Aquifers, as defined by TVA as being present.

28 TVA's Preferred Alternative for Closure-in-Place of the SWL and Ash Impoundment 2 allows for continued discharge of contaminated groundwater, leachate, and surface water runoff into Little Bayou Creek and the Ohio River because CCRs will remain in contact with groundwater. As a result of the continued "wet" CCR waste conditions, **one can expect vertical and horizontal seepage of contaminated groundwater and leachate to continue to flow into deeper portions of the underlying aquifer(s), into Little Bayou Creek, and into the Ohio River**.

TVA's plan for Closure-in-Place of the SWL and Impoundment 2 does not include *complete removal of all water* in the impoundments—including both standing water in the surface impoundments *and* the saturated pore water deeper in the wastes. Instead, TVA only plans to "decant" or remove the water *standing in open areas* of surface impoundments. *See, e.g.*, DEIS at 3, 37.

29 TVA's plan of only removing standing water on top of the CCR and not removing *all* liquids from within the saturated ash will not remove the mounding of subsurface liquid in the CCR. That mounding creates a higher-than-normal hydraulic gradient (*i.e.*, the slope of the groundwater) that will continue to form leachate that can more rapidly infiltrate into the groundwater—even after construction of cap during Closure-in-Place.

By contrast, as EPA has explained, the law requires otherwise:

> In order to close a unit with waste in place, the facility must meet *all of the performance standards* in § 257.102(d). If the facility is unable to meet the performance standards for closure with waste in place for a particular unit, *it must clean close the unit*.

EPA 2017 (emphases added); *see* 40 C.F.R. § 257.102.

30 "Clean close" means Closure-by-Removal, which involves excavating the wastes and re-disposing that waste into a lined landfill. If the wastes are submerged in groundwater or otherwise remain "wet" by a proposed Closure-in-Place method, that closure alternative will *not* meet the CCR Rule requirement for complete dewatering. EPA 2017. EPA has provided the following clarification of that requirement:

> Whether any particular unit or facility can meet the performance standards for closure with waste in place is a site-specific determination that will depend on a number of factual and engineering considerations, such as the hydrogeology of the site, the engineering of the unit, and the kinds of engineering measures available. For example, if a small corner of a unit is submerged in the underlying aquifer, a facility might be able to meet the performance standard for closure with waste in place for the majority of the unit, by "clean closing" the submerged portion of the unit, and installing the necessary engineering measures to ensure that the rest of the unit meets the performance standards in § 257.102(d).

Id.

31 Construction of a cap during Closure-in-Place will not prevent lateral inflow of groundwater into the CCRs from hydraulically up-gradient areas where such wastes are placed within and below the top of

the groundwater. The lateral inflow groundwater that flows through the CCRs will continue to form more leachate and contaminate groundwater that flows into Little Bayou Creek and the Ohio River.

32

In order for a closure plan to be compliant with EPA's closure performance standard for leaving CCRs in-place, the plan must meet the following performance standards related to leachate control and groundwater protection, among other listed obligations:

> (d) Closure performance standard when leaving CCR in place—
>
> (1) The owner or operator of a CCR unit must ensure that, at a minimum, the CCR unit is closed in a manner that will:
>
> (i) *Control, minimize, or eliminate to the maximum extent feasible*, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;
>
> (ii) *Preclude the probability* of future impoundment of water, sediment, or slurry;
>
> […]

40 C.F.R. § 257.102(d) (emphases added)

33

In light of the facts that TVA's own data indicate that CCRs are submerged in groundwater, and that water remains impounded in both the SWL and Ash Impoundment 2, **TVA cannot meet the CCR Rule performance standards for Closure-in-Place. Accordingly, the DEIS's Preferred Alternative for Closure-in-Place would be unlawful—and potentially dangerous.**

5. **Failure to Demonstrate Satisfaction Location Restriction Requirements**

34 Nowhere has TVA shown that its plan to laterally expand the SWL over Ash Impoundment 2 would satisfy the location restriction requirements legally required by the CCR Rule.

TVA's plan to horizontally expand the existing SWL over Ash Impoundment 2 requires that TVA meet Location Restrictions specified in the CCR Rule because that would constitute a lateral expansion of an existing CCR unit. The DEIS fails to address, as it should, how TVA plans to meet these restrictions. These significant CCR Rule restrictions include, *inter alia*, the following:

1. <u>Placement Above the Uppermost Aquifer</u>, 40 C.F.R. § 257.60 – Requires 5-foot separation between the base of the landfill and the uppermost aquifer.
2. <u>Wetlands</u>, *id.* § 257.61 – Requires that no new landfill or a lateral expansion of an existing unit be located in wetlands unless specific arguments are made.
3. 35 <u>Fault Areas</u>, *id.* § 257.62 – Requires that new landfills or a lateral expansion of an existing unit not be located within 60 meters of the outermost damage zone of a fault that has had displacement in Holocene time, unless the owner demonstrates an alternative setback distance will prevent damage to the structural integrity of the landfill.
4. <u>Seismic Impact Zone</u>, *id.* § 257.63 – Requires that new landfills and lateral expansions must not be located in seismic impact zones unless the owner demonstrates that the structural components will be designed to resist the maximum acceleration in lithified earth material.
5. <u>Unstable Areas</u>, *id.* § 257.64 – Requires that new landfills and lateral expansions must not be located in an unstable area unless recognized and accepted good engineering practices are incorporated into the design. Unstable areas can include wet, saturated or shallow groundwater soil conditions (as an example) that might result in differential settling due to disposal.

First, TVA claims that the Preferred Alternative of closing the SWL and Ash Impoundment 2 in-place and constructing a new CCR landfill will have "no impact on floodplains as all actions would occur outside of floodplains." DEIS at 89. That statement is misleadingly inaccurate, because TVA constructed the current Ash Impoundment 2 (and the proposed SWL expansion) within the 100-year
36 floodplain—*i.e.*, the blue-colored area in Graphic 7, below, as provided by TVA. TVA intends to modify the northwest portion of that impoundment (also likely within the original floodplain) by removing existing dikes; building a new Equalization Basin (also within the likely original floodplain), and building another horizontal expansion over Ash Impoundment 2 (also within the likely original floodplain). As such, under the DEIS's proposal, **that work would be constructed within what likely used to be the 100-year floodplain**, as defined by TVA. *See id.* at 87.

a. Graphic 7: 100-year floodplain encompassing Ash Impoundment 2 and the SWL

Next, the DEIS reveals no on-site investigation performed by TVA to identify local faults beneath any disposal area. TVA concluded that "while there are quaternary faults located in the Metropolis, Illinois area across the Ohio River, none are currently known within the SHF boundaries or immediate vicinity (USGS 2014). Therefore, impacts associated with ground fault rupture would not be anticipated." DEIS at 67. TVA is required to *know* if the units are located in fault areas. *See* 40 C.F.R. § 257.63. Nonetheless, TVA failed to perform such analyses and include them in the DEIS; rather, TVA appears merely to have made untested—and potentially grave—assumptions to that end. TVA acknowledges in the DEIS the importance of locating faults and in the near vicinity because it concluded that "the best mitigation for potential fault ground rupture to structures is to accurately
38 locate the fault and set back structures a safe distance from the fault," DEIS at 67—yet, again, it still failed to undertake and discuss those analyses. DEIS at 67.

My preliminary analysis of the Shawnee site using existing, publically available geologic information indicates, for one, that **the expansion area may not be suitable for the lateral expansion because of the likely presence of faults in that area and the presence of an active seismic zone**.

The Kentucky Geological Survey ("KGS") concluded in a study for the nearby Paducah Gaseous
39 Diffusion Plant, located approximately 2 miles to the southwest of the Shawnee site, that these fault conditions exist (*see* KGS 1997, at 5-6):

a) Faults of young (Quaternary and Tertiary) rocks were confirmed across the Ohio River, in Illinois.

b) Those faults and associated lineaments are northeast trending towards the TVA Shawnee Plant, as shown below in Graphic 8 (*see* KGS 1997, at 5-6).

c) The faults extend from the surface to the Precambrian basement and possibly deeper.

39 d) The faults mapped at the Gaseous Diffusion Plant “are probably the surface manifestations of buried Fluorspar Area Complex faults.” *Id.*

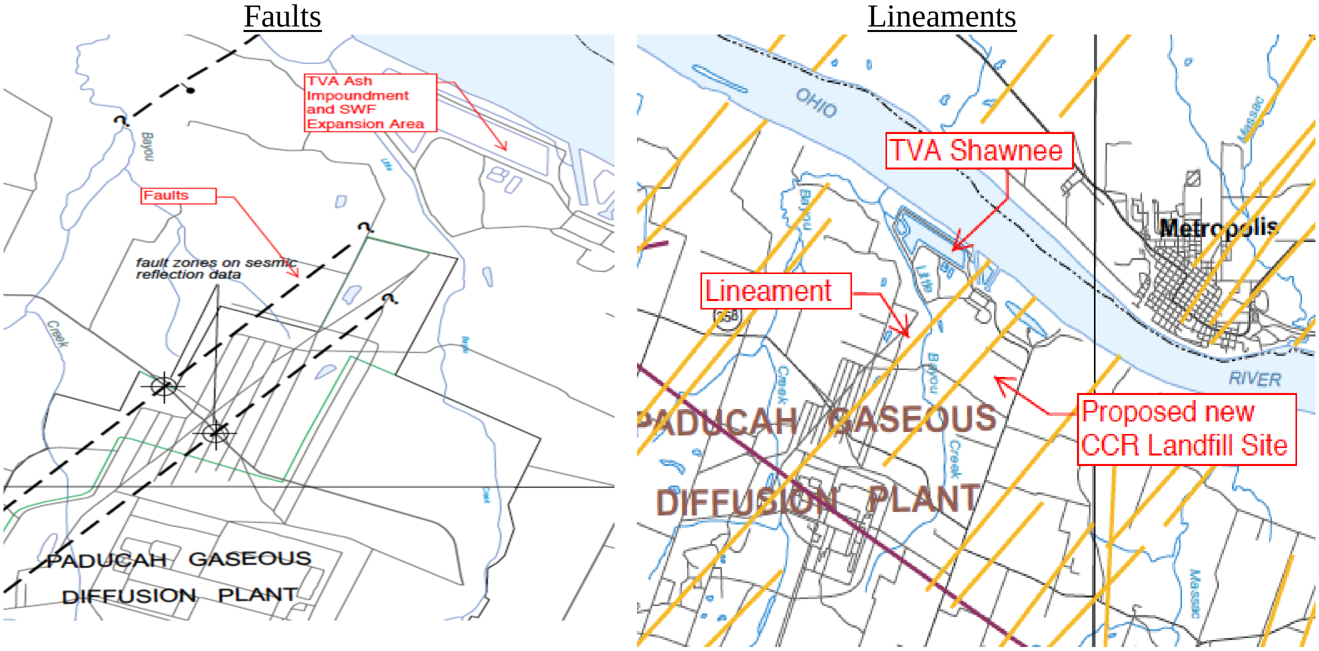
e) In all likelihood, the area around the Gaseous Diffusion Plant is “intensely faulted.” *Id.*

f) The number of identified earthquake centers in the plant area indicates “active faults at depth near the plant.” *Id.*

g) The northeast-trending faults are significant because they likely control the direction of groundwater flow and groundwater migration pathways.

b. Graphic 8: Fault lines and associated lineaments appearing below Shawnee

<u>Faults</u> <u>Lineaments</u>



Given the likely presence of faults beneath the TVA Shawnee property, TVA should have performed its own site-specific investigation prior to developing the DEIS. Had TVA performed the simple analysis above based upon the foregoing publically available information, at the least, it would (and should) have determined that a more in-depth analysis was required for the DEIS. And needless to
39 say, that information should have been included in the DEIS.

The analysis that I performed indicates that **faults and active seismic conditions likely exist at the property**. *See* 40 C.F.R. §§ 257.62, 257.63. As such, TVA’s plan for Closure-in-Place and construction of the proposed Shawnee East Site landfill **may not meet the CCR Rule’s location restriction performance standards—and may pose serious hazards.**

6. **Flaws in Alternatives Analysis with Evaluation Future “Dry” Landfill Sites**

47 TVA’s preliminary alternatives analysis to evaluate future “dry” landfill disposal sites to accommodate Shawnee’s waste generation plan was unreasonably brief; moreover, it resulted in the selection of land that was already purchased by TVA, that does not meet TVA’s minimum designated acreage requirement, and that likely would not meet the CCR Rule site location standards.

58 TVA states that the current CCR waste generation rate is 183,000 cubic yards per year; the current SWL has enough capacity to last another 10 years (to 2027); and the proposed new landfill would provide capacity for another 20 to 25 years past that (to 2047 or 2052). *See* DEIS at 161. TVA estimated that the future waste generation rate will increase to 490,000 to 910,000 cubic yards to the year 2040. *See id.* at 22. That generation rate results in increases of 200 to 400% compared to the current generation rate. TVA’s statement in the DEIS regarding the life of the newly proposed landfill is contradictory. TVA claimed that the life is both 20 and 25 years; it is unclear which is correct. *Compare id.* at 1 *with id.* at 20.

43 TVA apparently completed a detailed analysis in 2015 of potential land disposal options. The details of that analysis were reportedly described in a 2015 New Landfill Siting Study mentioned by TVA—yet that was not included in the DEIS. *See id.* at 9. Given the significance of that evaluation and the results needed to support TVA’s Preferred Alternative, TVA should have included that detailed, complete 2015 analysis in the DEIS. That unreasonable omission, like others noted herein, unlawfully renders the public unable to meaningfully review TVA’s decision-making and informedly judge the legal adequacy as well as the practical safety and wisdom of the DEIS’s plan.

TVA performed a “Preliminary Alternatives” analysis as part of the DEIS. *See id.* That analysis included three sites that were primarily used for agriculture (*i.e.*, farming). The acreage of those sites ranged from 298 to 935 acres. Of those three sites, two sites (Options 2 and 3) were not even available for sale and were apparently selected based on proximity to the Shawnee Plant and acreage. TVA actually already owns the other option (Option 1). Although TVA also considered three existing, privately owned permitted landfills in the vicinity, TVA ultimately selected the TVA-owned Shawnee East site as the “most feasible location for a new CCR landfill.” *Id.* at 18.

The total acreage of preferred Shawnee East Site landfill was 330 acres, of which TVA stated that an 88-acre footprint (*i.e.*, actual disposal area) would occupy the center of the site. *See id.* TVA has already begun to construct a “direct transportation route” haul road to the Shawnee East Site. *Id.* at 137, 139. That site is depicted below in Graphic 9 (*see id.* at 19):

a. Graphic 9: Shawnee East Site landfill

Only a portion of the 330 total acres of the Shawnee East landfill site can actually receive wastes because according to TVA, the remaining acreage would be used for perimeter buffer areas, roads, stormwater ponds, a leachate pond, a construction area, office buildings, and a soil borrow area, as illustrated above. DEIS at 20. TVA stated that the Shawnee East Site landfill would provide 8 million cubic yards of disposal capacity, which it equated to an expected 25-year life. *Id.*

44 **The Shawnee East Site does *not* however, meet TVA's stated minimum 140-acre footprint that TVA stated it needed for 8 million cubic yards capacity**. *See id.* at 9. As such, TVA should have determined that the site was unsuitable because it did not meet its minimum requirement.

41 TVA's alternatives analysis for evaluating all disposal site overstated the costs of disposal—assuming that TVA would have instead considered in the DEIS waste reductions through beneficial reuse. Because the CCR could otherwise be substituted as a raw material in future commercial products for sale, the CCR wastes could have instead been considered a revenue source rather than an expense in the DEIS. Waste reductions would result in less required acreage for disposal, less transportation costs, etc. that would have reduced the overall costs of the alternatives.

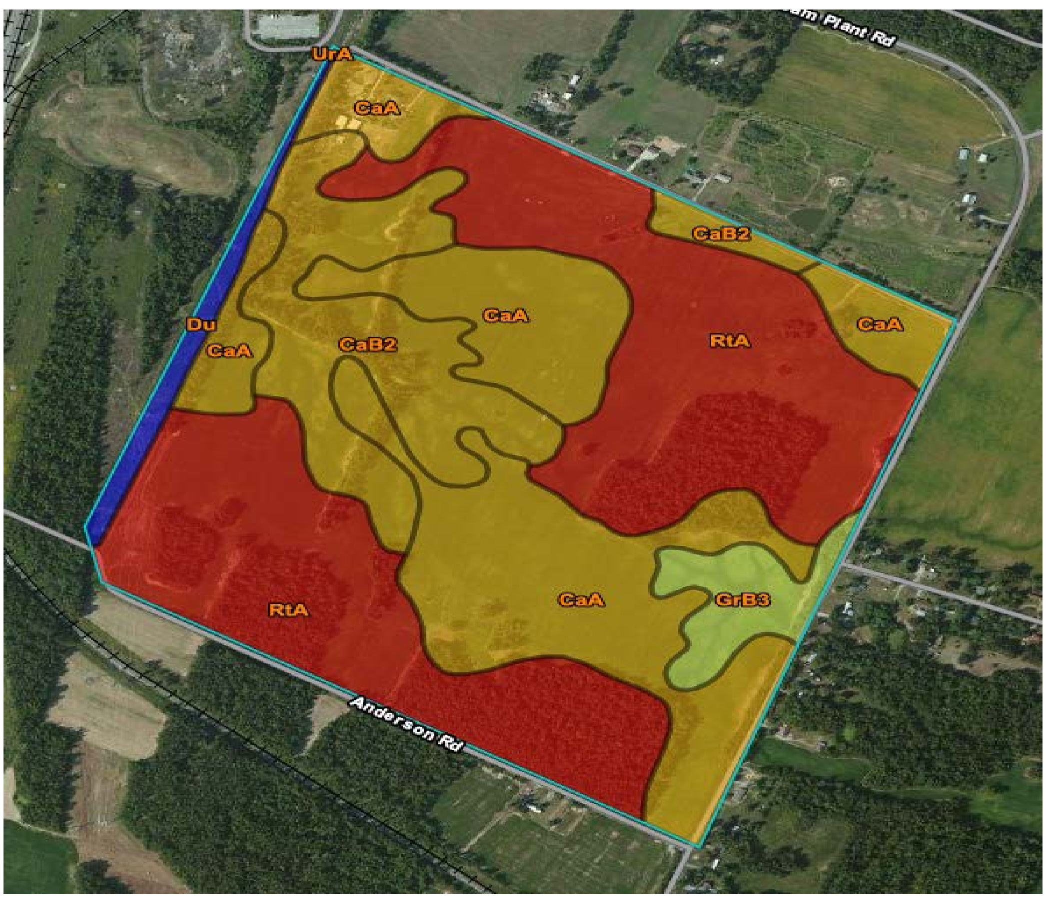
45 TVA states that the Shawnee East Site would be designed to meet the CCR Rule siting and composite liner requirements. DEIS at 20-21. The CCR Rule requires that new landfills have a composite liner

system that provides minimum 5 feet of separation between the base of the landfill and the uppermost aquifer. 40 C.F.R. § 257.60. TVA's plan to use the Shawnee East Site landfill as a "borrow area" to obtain soils to construct the cap over the SWL and Ash Impoundment 2 will remove the already existing thin layer of soil above the uppermost aquifer at that site. *See* DEIS at 37, 39. In other words, TVA plans to excavate soil that might otherwise provide the 5-foot buffer legally required by the CCR Rule. TVA relied upon the Soil Data Mapper created by the Natural Resources Conservation Service ("NRCS") to determine soil conditions at the proposed Shawnee East Site landfill site. DEIS at 59. I performed a similar analysis using the same Soil Data Mapper to evaluate if shallow groundwater conditions exist in the soil at that site. My analysis indicates that **the proposed site likely does not have adequate soil thickness to meet the required 5-foot separation between the base of the landfill and uppermost aquifer, as required in the CCR Rule, *even before excavating soils for use as borrow material, as proposed*.**

45

The NRCS reports very shallow groundwater in the soil at the proposed landfill site—in fact, the *deepest* groundwater at the site is reportedly *no more than 20 inches below ground surface*. NRCS 2017 at 3. Even worse, the area in red below illustrates soil conditions with a groundwater table—*i.e.*, the "uppermost aquifer"—approximately 6 inches below the ground surface. The groundwater table depth within the brown areas was only approximately 12 inches deep. As such, the Shawnee East Site likely cannot meet the CCR Rule requirement for separation from the uppermost aquifer. *See* 40 C.F.R. § 257.60.

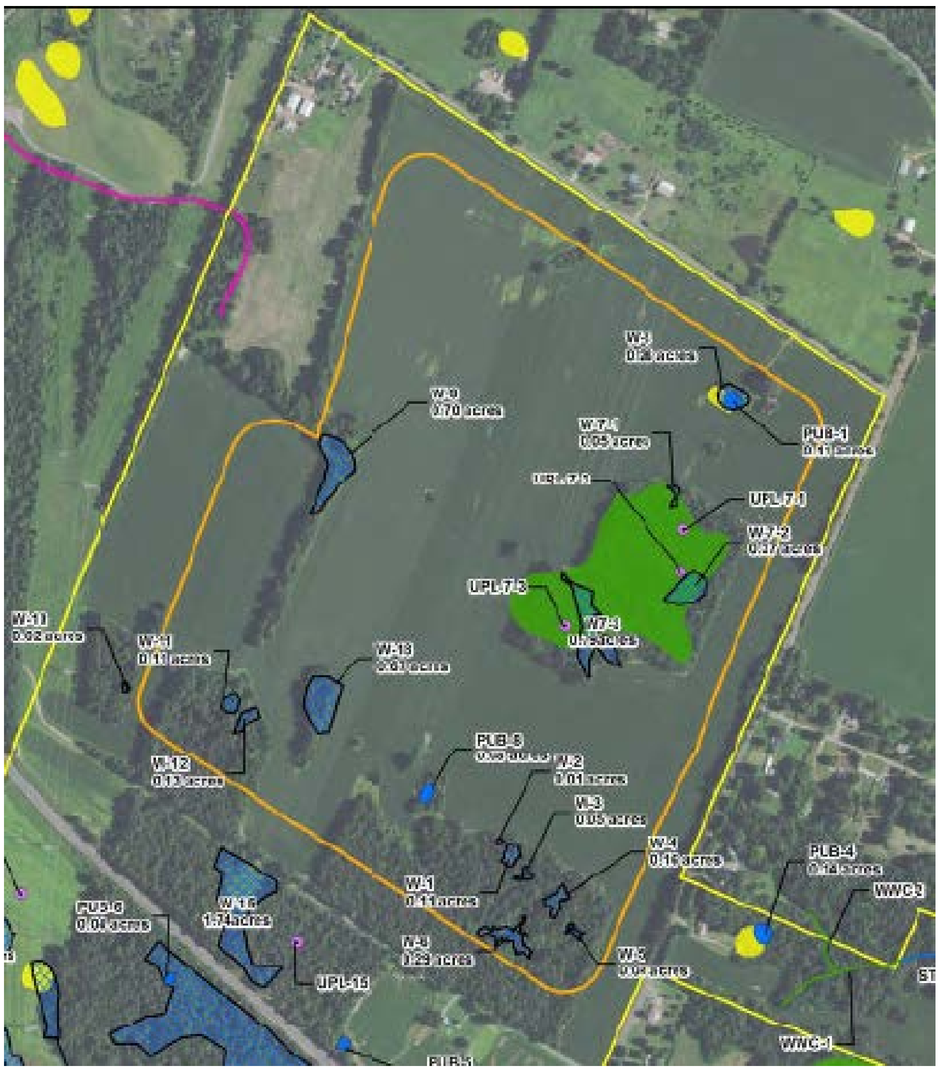
b. Graphic 10: Water table depth at the Shawnee East Site



45 TVA should have performed the simple aforementioned analysis prior to including the Shawnee East Site in its list of potential disposal site alternatives in the DEIS. TVA chose to use the same Soil Data Mapper to identify soil types that I used to generate the shallow groundwater conditions above, and yet TVA failed to use that same source to determine shallow groundwater conditions.

46 Such shallow groundwater conditions are expected given the widespread occurrence of wetlands and ponds that indicate very shallow groundwater on the property—features that TVA identified in the DEIS. In fact, TVA identified 19 wetlands totaling 22.4 acres on the proposed property, with 4.13 acres being present within the proposed CCR landfill footprint; TVA also identified numerous farm ponds. *See* TVA DEIS, Appendix D at 4 and 9, illustrated below in Graphic 11.

c. Graphic 11: Wetlands and ponds at the Shawnee East Site



46 With these wetlands on the Shawnee East Site in mind, TVA has failed to make a showing in the DEIS that might overcome the CCR Rule's rebuttable prohibition against CCR landfills and impoundments on wetlands. *See* 40 C.F.R. § 257.61

Further, the locations of wetlands and farm ponds are where one would expect them to be on the property: in the areas with the shallowest groundwater table according to the NRCS. Given the widespread shallow groundwater conditions at the Shawnee East Site, the site likely does meet the new CCR landfill location restriction for separation with the uppermost aquifer according to the CCR Rule and may not even be suitable as a soil borrow area. As soil is excavated to obtain borrow material to construct the cap for the SWL and Ash Impoundment 2 Closure-in-Place, one would expect more shallow ponds to form at the Shawnee East Site.

46

The DEIS's discussion of groundwater conditions at the Shawnee East site acknowledged only the deeper Regional Gravel Aquifer; it failed to confront the shallower Alluvial Aquifer and the Upper Continental Deposits Aquifer that are both likely present at the site. TVA's groundwater discussion of the Shawnee East site concluded that the potentiometric surface (of an unspecified aquifer) varied substantially from winter to summer months, with a maximum elevation of 357 feet MSL. When that elevation is compared to the current ground surface elevations illustrated below in Graphic 12 (*see* USGS 1982), that groundwater elevation is within 3 feet of the lowest ground surface elevation for that property (360 ft. MSL). As a result, the site does not provide the required 5-foot separation according to the CCR Rule.

d. Graphic 12: Land Surface Topographic Map

48 In summary, my review of the DEIS in conjunction with publically available data reveals that the Shawnee East Site landfill likewise appears to violate the CCR Rule's Location Restrictions. *See* 40 C.F.R. §§ 257.60–257.64. TVA should have included in-depth analyses of how the proposed site might meet the applicable restrictions and obligations.

7. **Unreasonable Elimination of Closure-By-Removal**

TVA's elimination of Closure-by-Removal as a facility-wide alternative in the DEIS was not based upon reasonable facts and considerations that TVA should have considered in its analysis.

49 TVA concluded in the DEIS, that both Closure-in-Place and Closure-by-Removal of surface impoundments can be "equally protective of human health and the environment, provided they are implemented properly." DEIS at 24. Given that TVA's plan for Closure-in-Place does not meet the CCR Rule performance standards, as discussed herein, TVA's plan for closure-in-place is not as protective as Closure-by-Removal.

50 TVA's concluded in the PEIS that Closure-by-Removal would have a "greater beneficial impact on surface water and groundwater quality than Closure-in-Place if the water table intersects the CCR." TVA 2016, at 32. TVA also confirmed a similar reduction of groundwater contamination in the DEIS for Shawnee when Closure-by-Removal is used. *See* DEIS at 24. Given that groundwater saturates the wastes in the SWL and Ash Impoundment 2, Closure-by-Removal would be a more protective closure alternative.

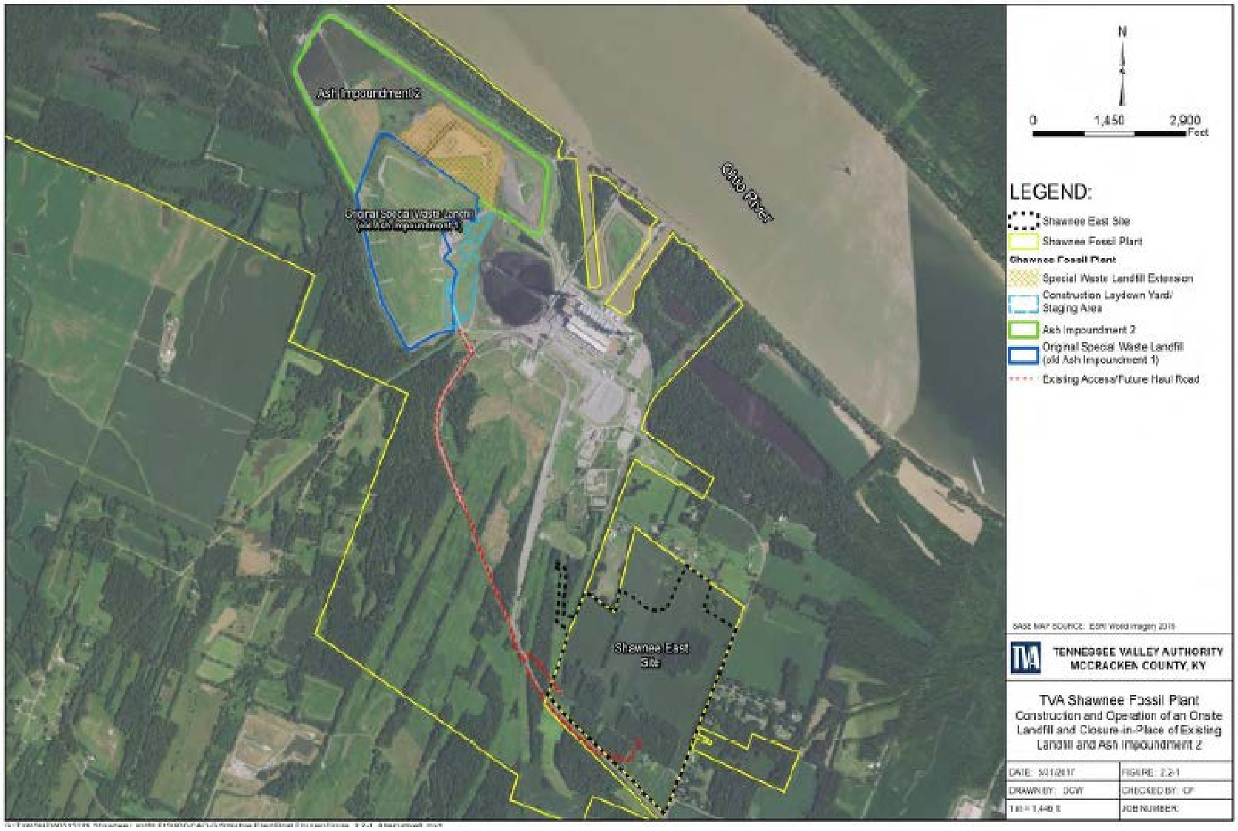
51 TVA concluded that the CCR Rule requires a "5-year closure window" for Closure-by-Removal as a reason why such closure was not reasonable. DEIS at 35. That conclusion fails to recognize that the EPA allows an owner to apply for an extension for closure. *See* 40 C.F.R. § 257.102(f). Such an extension allows for reduced transportation trips, as an example, which would invalidate some of TVA's assumptions that eliminated Closure-by-Removal as being feasible.

52 TVA and Stantec assumed that wastes that would be excavated and hauled off-site in a Closure-by-Removal closure would be hauled to an *off-site* landfill, rather than evaluating hauling and disposing of that wastes into an *on-site* landfill on property already owned by TVA. If TVA would have instead considered an on-site landfill in their analysis, the costs for transportation would have been minimal: No tipping fee would have been paid for disposal; larger trucks could be used to reduce truck trips per day; and no off-site impacts would be realized due to off-site transportation (e.g. noise, truck traffic).

53 Moreover, TVA also did not include in its Closure-by-Removal analysis the economic benefit and cost savings associated with excavating CCRs and beneficially reusing that material in products that are sold. *See infra* Section 9.

54 Further, TVA and Stantec assumed that an on-site landfill of sufficient footprint and volume capacity cannot be constructed on land already owned by TVA—yet TVA already owns substantial land acreage capable of meeting TVA's 140-acre minimum footprint requirement (and considerably more), as illustrated below within the yellow lines in Graphic 13 (*see* DEIS at 40):

a. Graphic 13: Land ownership surrounding Shawnee



8. **Improper Omission of Pertinent Information Regarding All Waste Disposal Areas**

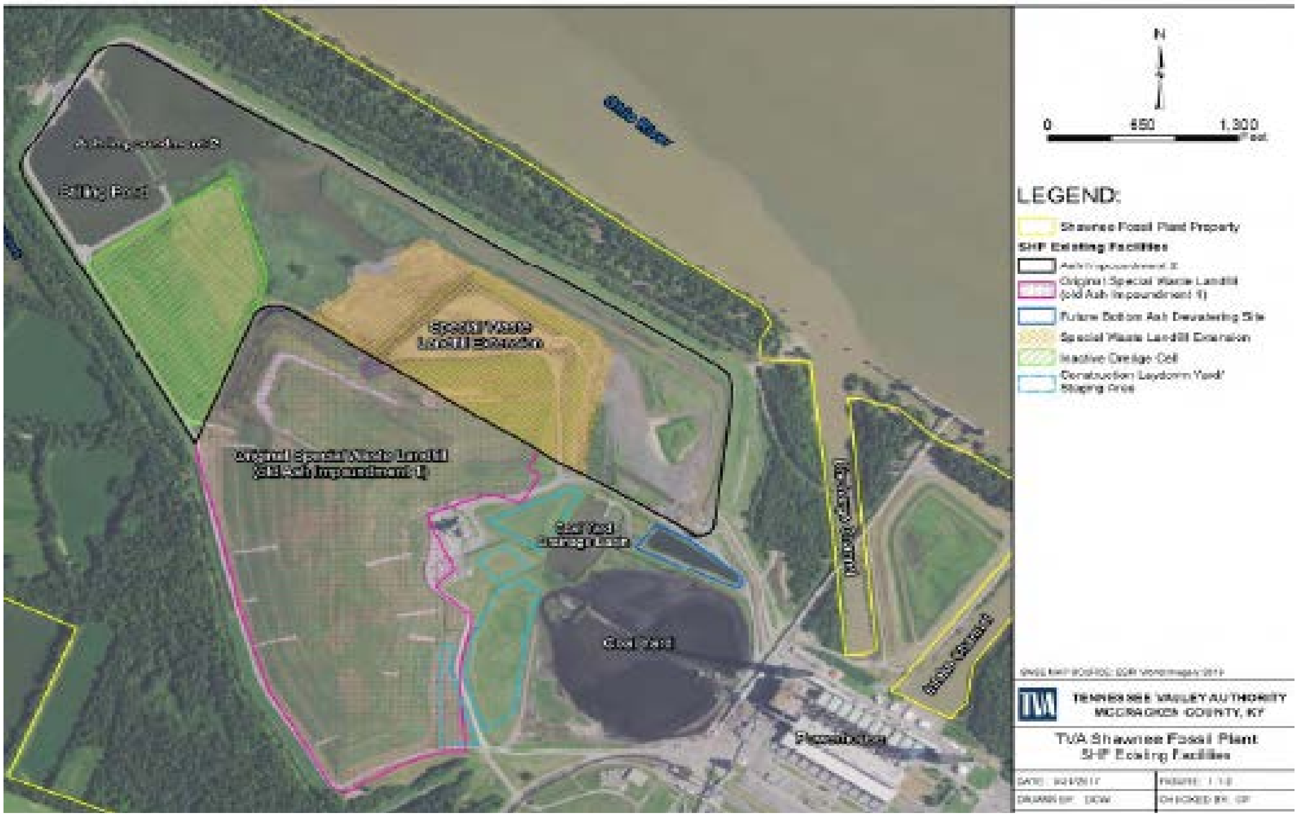
55 The DEIS improperly omits relevant information regarding all past, current, and proposed future waste disposal areas. As such, the DEIS does not properly evaluate the waste management process in compliance with the CCR Rule and NEPA.

56 TVA's plan for closure of the SWL and Ash Impoundment 2, as laid out in the DEIS, differs in comparison to what TVA illustrated on its publicly available CCR Rule website.[11] On its CCR Rule website, TVA considered the Dredge Cell as part of the SWL, rather than being a part of Ash Impoundment 2 as illustrated in the DEIS (*see* green area in Graphic 14, on the following page).

[11] *See* https://www.tva.gov/Environment/Environmental-Stewardship/Coal-Combustion-Residuals/Shawnee (last accessed 7/27/2017).

a. Graphic 14: Comparison of DEIS depiction to TVA CCR website depiction

DEIS



TVA CCR webpage

The Dredge Cell that TVA constructed in 1983 with dikes made of ash is prone to failure and unstable conditions. The Dredge Cell contains a significant amount of wastes (750,000 cubic yards). 56 *See* Stantec 2016a at Appendix B. As one example of that instability, the dike built of ash failed in 1984 and created a "wave" of water that destroyed the water risers in the adjacent Stilling Pond. *See* Stantec 2016a at Appendix B. TVA did not specifically identify the unstable conditions in the DEIS or how it intends to remedy these conditions during closure.

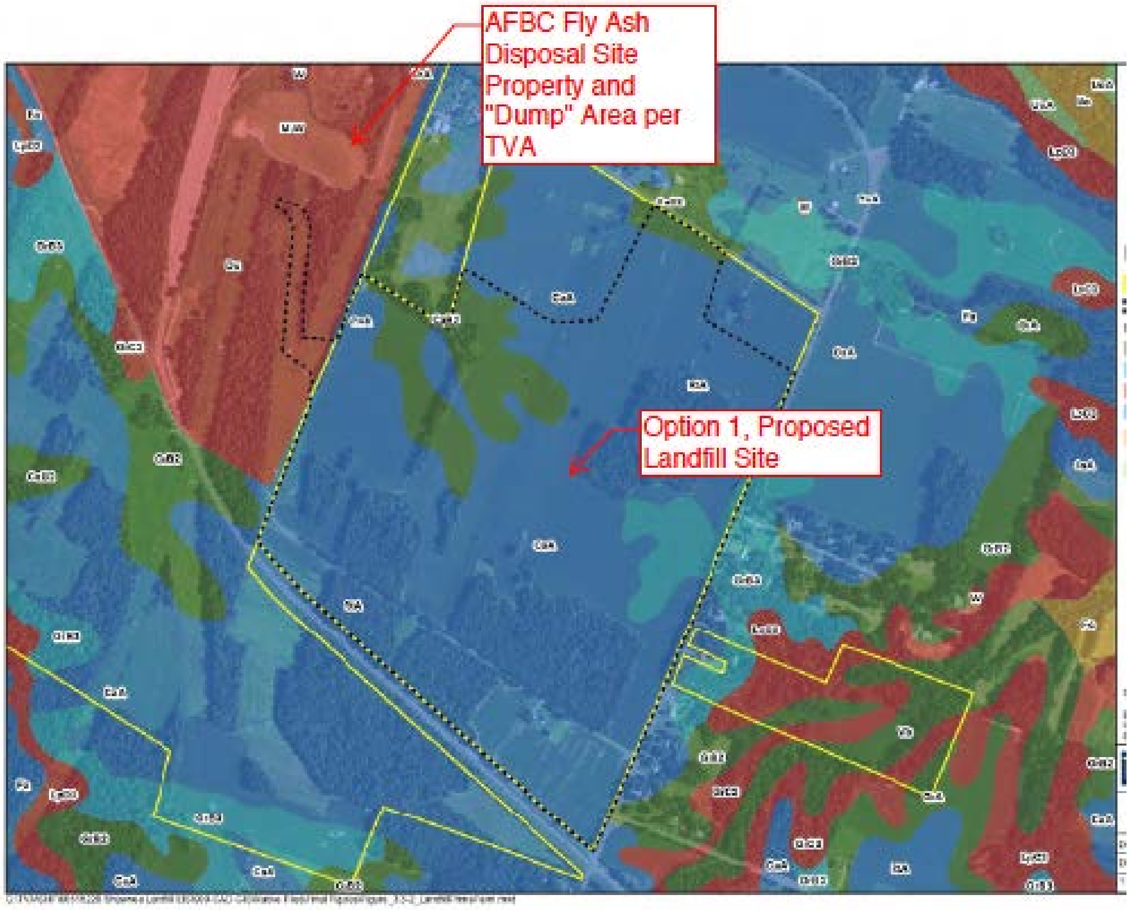
TVA stated that, during completion of a 2015 New Landfill Siting Study, "new information regarding the seismic conditions of the area and the stability requirements since the original permitting 59 prompted TVA to impose a capacity limit to be disposed of in the SWL." DEIS At 9. TVA did not elaborate on what that "new information" was, yet should have included that information in the DEIS. Clearly, this new revelation suggests that the SWL (*i.e.*, Ash Impoundment 1) disposal site is characteristically unstable for unspecified reasons.

TVA fails to discuss one former disposal areas located on-site: the AFBC Fly Ash Disposal Area located southeast of rail loop, depicted by TVA below and highlighted in red in Graphic 15. The 55 DEIS does not show or explain if that disposal area has ever been properly closed consistent with the closure performance standards in the CCR Rule or any KDWM standard. Stantec identified that disposal area in its "History of Construction" document that it prepared for Ash Pond 2. *See* Stantec 2017a, Appendix B.

b. Graphic 15: Depiction of AFBC Fly Ash Disposal Area

55 The soil data investigation presented by TVA in the DEIS appears to confirm the presence of widespread wastes in the AFBC Fly Ash Disposal Area. TVA's use of the NRCS Soil Data Mapper in the DEIS identified soil types at and near the proposed Shawnee East Site landfill. During its review, TVA identified a soil type called "dump" in the area northwest of the site, as illustrated in red in Graphic 16, below, and from within Table 3.4-1 in the DEIS:

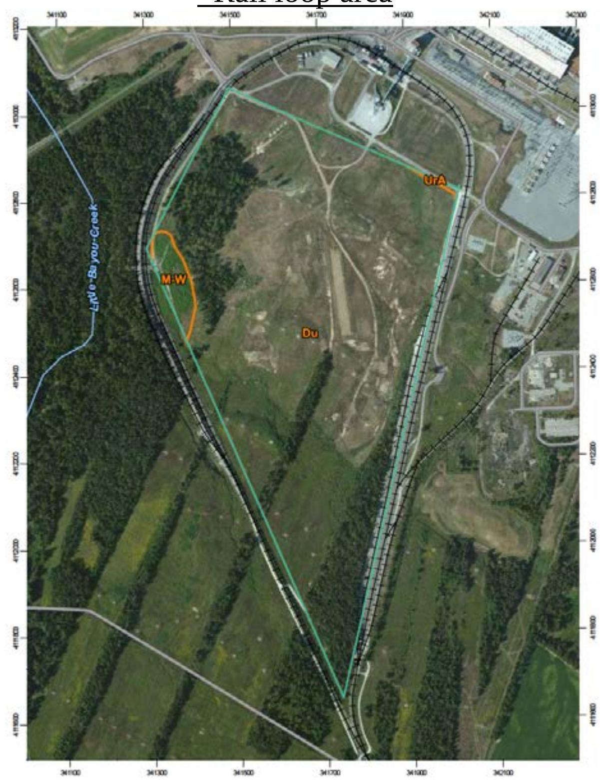
c. Graphic 16: Dump identified next to Shawnee East Site



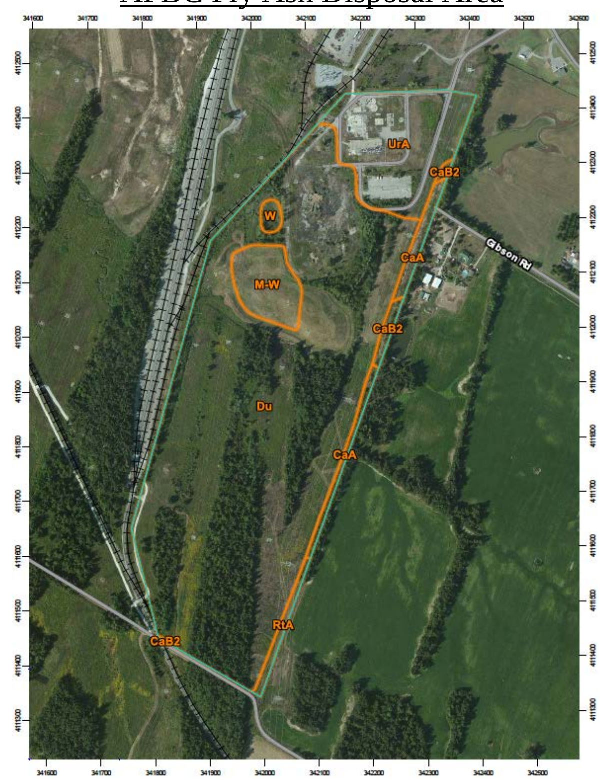
55 I performed a similar NRCS analysis on the above area identified by TVA as being a "dump," in addition to another TVA-owned area northwest of that area called the "rail loop" area. That analysis, as illustrated in the figures below in Graphic 17, suggests that TVA also disposed of unspecified CCR wastes into that rail loop area, which indicates that a second undisclosed disposal area exists.

d. Graphic 17: Rail loop and AFBC Fly Ash Disposal Area past disposal sites

Rail loop area



AFBC Fly Ash Disposal Area



55 **TVA failed in the DEIS to identify, and thus to confront the relevance of, either the AFBC Fly Ash or the rail loop area as being past disposal sites.** TVA should have included a discussion of both the AFBC Fly Ash Disposal Area and the rail loop areas (and any other disposal areas that may not yet have been disclosed), including how TVA plans to properly close all of those former disposal area.

60 Meanwhile, TVA's plan for closure of Ash Impoundment 2 includes construction of a new Equalization Basin that would receive wastewaters from the Shawnee Plant. *See* DEIS at 28, 31, and 38. However, TVA did not include any pertinent details—such as design parameters, operation, treatment capabilities, location, orientation relative to impoundments, etc.—about this wastewater treatment area. Given its significance as an integral part of TVA's closure and continued landfill operations plan, TVA should have included details in the DEIS such as:

1. Reuse of on-site wastewaters for a zero discharge rather than constructing a new basin.
2. Discharging wastewater to the local publicly owned wastewater treatment facility.
3. Where the basin will be constructed.
4. How the basin will be constructed to protect groundwater.
5. What treatment mechanism will be used to treat the water to remove constituents of concern.

9. **Failure to Include Analysis of Beneficial Reuse of CCR**

TVA failed to include, as it should have, analysis of beneficial reuse, in evaluating waste alternatives. Currently disposed and future wastes are capable of being beneficially reused in commercial products. Factoring in that analysis could materially change the relative economics of, and therefore TVA's informed choice between, the different alternatives.

TVA stated (near the end of the DEIS) that CCRs can be beneficially reused "in the manufacture of wallboard, roofing, cement, concrete, and other products," and that "CCR not sold for reuse are currently managed at the SWL." DEIS at 161. TVA did not discuss any plans or include any beneficial reuse options in its alternatives analysis in the DEIS. Further, TVA never stated how much (if any) CCRs are sold, have been sold in the past, or otherwise beneficially used in any commercial product. TVA's statement in the DEIS that operation of the proposed Shawnee East Site landfill "would not change the quantity of CCR wastes generated at SHF annually" suggests that TVA does not intend to beneficially reuse CCRs in any commercial product. *Id.* at 163.

40 TVA has partnerships with third party companies at other TVA coal-fired power plants to beneficially reuse CCR as raw material substitutions for commercial products. For example, at the TVA Cumberland Fossil Plant, flue-gas desulfurization ("FGD") wastes are used to manufacture wallboard at an adjacent manufacturing plant. TVA should have included such an analysis and consideration for identifying third-party uses in its alternatives analysis in the DEIS.[12]

TVA estimated that its proposed plan to build the Shawnee East Site landfill will be needed to meet a 10 to 20 million cubic yard total capacity as part of its desired 20-year comprehensive disposal plan, and that 8 million cubic yards will be generated between 2020 and 2044. *See* DEIS at ES-1 and 9. Such large capacity and associated costs would be unnecessary if TVA instead developed and initiated a comprehensive plan to beneficially reuse future wastes to reduce the costs and land area that it says is needed for disposal (*i.e.*, 140 acres—not including buffer, roads, leachate pond, etc.).

If TVA were to beneficially reuse current and future wastes, its alternative analyses and its 20-year (or 25-year) plan would change, because less disposal acreage and lower transportation costs (as non-exhaustive examples) would be required. At the very least, the omission of any meaningful discussion of the potential for beneficial reuse of CCR from Shawnee specifically was unreasonable; TVA's decision-making cannot lawfully stand without it.

---

[12] *See also supra* pp. 21, 25.

10. **Improper Reliance on Programmatic EIS and EPRI Framework Model**

The DEIS improperly relies upon the Programmatic EIS ("PEIS") and its Electric Power Research Institute ("EPRI") Framework Model to support Closure-in-Place of the Special Waste Landfill and Ash Impoundment 2. The EPRI Framework Model, which the PEIS in turn relied upon, is flawed and should not have been invoked for the Shawnee site.

TVA incorporates its PEIS (*see* TVA 2016) as a basis for closing surface impoundments in the more recent DEIS for Shawnee, stating that "a portion of this EIS is intended to tier from the 2016 PEIS to evaluate closure alternatives for the Ash Impoundment 2 and analyze the impacts of closure of the SWL." DEIS at 3. TVA accordingly relied upon the technical components of the PEIS in the current DEIS.

69 The PEIS, in turn, relied upon EPRI and its use of the Relative Impact Framework environmental impact model. That EPRI model did not use actual site-specific Shawnee site conditions but rather *assumed* generic site conditions to a *hypothetical* surface impoundment to select the Closure-in-Place alternative as TVA's preferred system-wide closure approach.

For example, EPRI's flawed assumption in the Framework Model that arsenic is a "low mobility" CCR constituent that is more slowly transported in water (*see* TVA 2016, at 34) does not consider that arsenic and other metals can have a high solubility and transport rate under a variety of pH conditions. As such, EPRI's assumption is not universally correct, and their model under-predicts the possible impacts at/near Shawnee associated with some CCR constituents.

In conclusion, the EPRI Framework Model—and hence the PEIS that relied on it—does not support TVA's selection of the Closure-in-Place alternative because it fails to use site-specific information to properly quantify alleged groundwater improvements by concentration or duration in groundwater or surface water, as one example.

11. **REFERENCES**

The below materials (many of which are too large to attach) have been collected and made available for download at the following publicly-accessible Box site: https://app.box.com/s/rz005s7adftddh5ghugvzlmznlemdsti

1) EPA 2008: Drinking Water Health Advisory for Boron, May 2008.

2) EPA 2017. U.S. Environmental Protection Agency, *Relationship Between the Resource Conservation and Recovery Act's Coal Combustion Residuals Rule and the Clean Water Act's National Pollutant Discharge Elimination System Permit Requirements*, last accessed 7/27/2017 at: https://www.epa.gov/coalash/relationship-between-resource-conservation-and-recovery-acts-coal-combustion-residuals-rule#Closure.

3) KDW 2001. Total Maximum Daily Load (TMDL), Little Bayou Creek, November 2001.

4) KGS 1997. Geologic Features Relevant to Ground-Water Flow in the Vicinity of the Paducah Gaseous Diffusion Plant, Kentucky Geological Survey, Open File Report OF-97-02, April 30, 1997.

5) Mactec 2007. Law Engineering July 10, 2000, Report of Drilling Services, Shawnee Fossil Plant, March 7, 2007.

6) NRCS 2017. Depth to Water Table, Web Soil Survey, National Cooperative Soil Survey, June 28, 2017.

7) Stantec 2016a. *History of Construction*, Ash Pond 2, Shawnee Fossil Plant, October 12, 2016.

8) Stantec 2016b. *Closure and Post-Closure Plan*, Ash Pond 2 and Consolidated Waste Dry Stack, Shawnee Fossil Plant, October 12, 2016.

9) Stantec 2016c. *Liner Design Demonstration*, Ash Pond 2, Shawnee Fossil Plant, October 6, 2016.

10) Triad 2016. Initial Annual (Intermediate) Inspection, Shawnee Fossil Plant, letter to James Roy Quinn III, TVA from Mark Levy, P.E., P.G., Triad Environmental Consultants, January 14, 2016.

11) TVA 1982. *Potential Groundwater Quality Impacts at TVA Steam Plants*, Report No. WR28-2-520-119, Harris and Foxx, TVA Division of Water Resources, September 1982.

12) TVA 1987. *Shawnee Ground-Water Assessment Proposal*, Report No. WR28-3-35-108, Carpenter and Lindquist, TVA Engineering Laboratory, September 1987.

13) TVA 1989. *Shawnee Groundwater Assessment*, Phase I, Report No. WR28-2-35-110, Lindquist and Bohac, TVA Engineering Laboratory, March 1989.

14) TVA 2010. *Groundwater Monitoring Report*, 2nd Quarter 2010, Special Waste Landfill, Shawnee Fossil Plant, August 2010.

15) TVA 2016. Final Part I Programmatic Environmental Impact Statement, June 2016.

16) TVA 2017. *November 2016 Groundwater and Surface Water Monitoring Reports for Second Half of 2016*, to Deborah Long, KDWM, from Abigail Bowen, January 30, 2017.

17) USGS 1954. Joppa Quadrangle Topographic Map, 7.5-Minute Series, 1954.

18) USGS 1982. Joppa Quadrangle Map, 7.5-Minute Series, 1982.